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CHAPTER XI

HEALTH AND SANITATION

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JUNE 1945

CHAPTER XI

HEALTH AND SANITATION

110. Introduction

The present chapter is concerned with public-health factors which influence health and sanitation, with medical facilities in the wider sense, and with information about diseases in the area described by Celebes south of the equator, by the Molukken Islands south of the equator and excluding Halmahera, and by the islands of the Banda Sea. Islands situated along the coast of Celebes are Koena, Poetoeng, Selajar, Kabaena and others. The large Molukken Islands included in this chapter are Boeroe, Ceram, and Amboina .

Important island groups which themselves are parts of the Molukken Islands include the Soela Islands, the Amboina Archipelago, and the Batjan Islands. Other islands in this survey, such as the Kai Islands, Aroe Islands, Tookangbesi Islands, Tanimbar Islands, Southeastern Islands and Southwestern Islands, are considered by some geographers to be parts of the Molukken Islands. All these islands, before the Japanese invasion, were parts of the Netherlands East Indies.

The environmental factors considered in this survey include water supplies, sewage disposal, animals which can transmit diseases to men, and food.

Water is plentiful in most of these regions; those excepted are the very small islands, particularly in the southeastern part of the general area. The larger islands have perennial streams; in the smaller islands streams may be seasonal only. Springs, free-flowing artesian wells, and shallow wells, which in certain smaller islands may contain brackish water, occur throughout the area. Lakes are uncommon, except for Celebes. The annual precipitation, in most parts of Celebes, is heavy; among the other islands, especially in the southeast, the annual rainfall varies considerably. In most areas, properly constructed and located wells should produce adequate quantities of potable water. If, however, water is obtained from sources in or close to villages, it should be given careful treatment, including chlorination, before it is consumed. Such details as are given herein concerning water distribution systems represent information that was available at the time the Japanese occupied the general region in 1942; but in some instances, in the smaller islands, such data, even prior to 1942, were

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incomplete. The result is that a complete picture of the situation as it may be encountered today cannot be given herein.

In almost all the rural regions of this area the disposal of sewage is primitive. Water-carriage disposal systems do not exist. Pollution of the soil should be considered to be the rule, not the exception, almost everywhere.

Information concerning the most dangerous vectors of disease is believed to be reasonably accurate, but probably not complete. Geography has imposed certain problems in this respect; an organism definitely reported to exist on one island is not necessarily absent from adjacent islands, yet, if it has not been reported from the latter places, it is of course impossible to state that it does occur there. Ticks, fleas and lice occur; more species than those mentioned herein may be encountered as different isolated regions in this general area are entered. Rodents are numerous. A natural reservoir of infection probably exists on Celebes, at least.

The native peoples of this entire area subsist largely on either rice or sago (sagu). Corn, fish and some animals are utilized as foodstuffs in various regions. Information made available in 1945

indicates that since this area was occupied by the Japanese, under-nourishment, anemia and deficiency of the vitamin B complex have increased sharply.

The medical and sanitary services of the area were not adequate, even before the Japanese invasion. Information secured in 1945 tends to show that the situation may be even worse now; in liberated sections of New Guinea, for instance, instruments, medicines and supplies have vanished, such hospitals as remain standing have been stripped of furnishings, measures of sanitary control routinely applied by the government of the Netherlands East Indies had not been continued, and, in many places, persons who had such diseases as malaria, dysentery and certain other conditions never were treated by the Japanese.

Physicians in the area before the Japanese invasion were well trained, but far too few. Some were military physicians; some were government civil servants; some were native medical practitioners educated in the Netherlands East Indies; some were missionaries; a very few, situated in Makassar on Celebes, were private practitioners. In near-by liberated areas of the Netherlands East Indies it was discovered in 1945 that only native personnel remained after the Japanese had been driven out.

Diseases which are of importance in this area include malaria, dysentery, scrub or mite-borne typhus and also murine or flea-borne typhus, filariasis, venereal disease, diseases of the skin, common diarrheas, respiratory infections, and, as reported in 1945 from Celebes, cholera.

Official medical and sanitary reports from this area of course have have not been published since the Japanese occupation. Those which have been obtained, however, pertained to as recent a year as 1938. Other medical and sanitary data from this area were issued as late as 1942. Still other information has been secured in 1945 from the first-hand accounts of persons escaping from the Japanese-dominated area, and from medical and sanitary reports from contiguous regions recently liberated from the Japanese. Such information as has been received is believed to be reliable, but is not complete, in respect to the thousands of small islands concerned. In many places, even before the Japanese invasion, disease statistics were not available.

III. Environment

A. Water supply.

(1) Celebes (north to the equator).

(a) Precipitation. Over most of the island annual precipitation exceeds 60 inches. Over a considerable area it is more than 100 inches. On the western coast of central Celebes the average annual rainfall is 21 inches; in the eastern mountain area of central Celebes it has been as much as 184 inches. Generally, in most parts of Celebes, rainfall is evenly distributed. The plain of Paloe, however, has been known as one of the driest areas in the Netherlands East Indies. Elsewhere, particularly in the southeastern part of Celebes, there is a shortage of water during the dry season.

(b) Water resources.

(1) Surface and ground water. Ground water is readily available in many parts of Celebes. The Koro River, originating in the central part of the island, empties into the Straits of Macassar. Other smaller streams exist. In certain regions streams disappear from the surface and traverse limestone strata, to appear again as springs.

(2) Wells. Water is readily obtainable from shallow, dug wells or drilled wells in many areas, particularly in the alluvium-filled valleys and so-called plain country along the coast. In some areas of Celebes there are free-flowing artesian wells; the yield of such wells probably could be increased by pumping. Most other wells are primitive, uncased dug wells only a few feet deep, which yield small amounts of water. During the dry season such wells often become almost dry. In many cases a few wells serve an entire village.

(3) Cold springs. There are many springs on Celebes. Some, as noted above, are the results of rivers or streams which have descended to underground channels along limestone strata, to reappear as great springs.

(c) Water systems. Less than a third of the population of Celebes was served by a public water supply. The quantity of water available was less than 10 gallons per capita per day on the basis of the total population, and less than 40 gallons per capita per day on the basis of the estimated population served. Nineteen towns in that part of Celebes considered in this survey are reported to have municipal water supplies. These supplies may or may not include distribution systems; it is probable that such systems, if present, are at best antiquated or

rudimentary, judged by American standards. Nothing is known of distribution systems in 7 of the aforementioned 19 towns.

(d) Purification. It is seen from Table XI-1 that the water of only 3 towns on Celebes was treated in the days before the Japanese invasion, and that the water of only one of these 3 towns was considered safe by Dutch officials. Most systems on Celebes provided small quantities of water from wells, springs and sometimes, surface sources. This water almost never was treated. The situation now probably is unchanged; it may be worse.

(e) Quality. Water from almost any stream in Celebes usually is turbid, and is likely to be highly contaminated. Near the coast and on a few near-by islands some wells yield brackish water; in such locations drinking water must be imported. Generally, water in shallow wells is likely to be contaminated; this may be true, likewise, of water from some larger wells and from artesian wells. Properly located and constructed wells on Celebes should deliver safe water. Spring water is somewhat more mineralized than stream water, occasionally is warm, and may be contaminated, particularly in areas of limestone formations. This water probably is satisfactory from a chemical standpoint. Shallow water in ponds

or pools should be considered contaminated. The same probably is true of water accumulating in fissures in impermeable rock or similar depressions, even in isolated regions. It will be seen in Table XI-1 that Dutch officials considered water to be safe for drinking in only three towns in Celebes. In one of these towns, the source was not stated; in another it was wells and surface supplies; in the third it was wells and springs.

(2) Islands other than Celebes.

(a) Precipitation. In the northern and western portions of the area of this survey the islands receive 70 to slightly more than 100 inches of water annually in the coastal areas, and as much as 150 inches in the highlands. In the southeastern portion of the area the annual rainfall is somewhat less (82 inches in the Aroe Islands and 65 inches in the Tanimbar Islands). The Batjan Islands, in the vicinity of Halmahera, receive rainfall in the form of a slow drizzle during the southeastern monsoon (May to October) and sharp showers during the northwestern monsoon (November to April). These islands have a hot, moist, equatorial climate. Southwest of the Batjan group, the Soela Islands receive 70 to 115 inches along the coast, and as much as 150 inches in the higher lands. Some rain water is collected by the natives; Occidentals collect it for both drinking and culinary purposes. Islands of the Amboina Archipelago, such as Saparoea, Haroekoe and Noesalaoet, have an average rainfall of about 140 inches. The monthly maximum of about 25 inches is attained in June. The western monsoon is dry; the eastern, wet. The average annual rainfall on Amboina and Saparoea is shown in Table XI-2. On Ceram a high mountain chain which

runs from east to west gives that island completely different climates in different sections: on the northern coast the western monsoon (December to March) brings rain, and the southeastern monsoon (June to November) is dry, whereas on the southern coast the southeastern monsoon brings rain, whereas the western monsoon is dry. The average annual rainfall on the northern and southern coasts appears in Table XI-3. Nearly all the houses on Ceram which have galvanized iron roofs are equipped to catch and store rain water for domestic use. Boeroe, west of Amboina and Ceram, receives rain when the western monsoon is blowing; the dry season begins when the eastern monsoon commences. The Banda Islands, south of Ceram, have a rainy climate, but rainfall quickly disappears into the loose volcanic soil. Rain water is collected in these islands, and it is said that some water is obtained in the form of condensed steam from volcano craters on Nila, Teoen and Seroea. The average annual rainfall is shown in Table XI-4. In the Kai Islands the average annual rainfall exceeds 93 inches (Table XI-5). The Aroe Islands, easternmost of the Moluccas, have a variable amount of precipitation: in some places there are prolonged droughts. The annual rainfall reported in Table XI-6 is for one place only. In the Tanimbar Islands, southwest of the Aroes, water is scarce and unpalatable. In Saumlakki, capital of the Tanimbar Islands, the average annual rainfall is slightly more than 65 inches (Table XI-7).

(b) Water resources.

(1) Surface and ground water. In the islands about Halmahera, on the southwest, there are many perennial streams. Surface water generally is low in mineral content, but high in organic products, with decided color and unpleasant oder and taste. Ground water is hard when it is taken from limestone areas, but otherwise is not highly mineralized. Near the coast of some of the larger islands, and throughout the smaller islands, ground water usually is salty at some point below sea level, but a lens of fresh ground water floats on the salty ground water. On some of the smaller islands, particularly the coral islands less than a half-mile wide, all ground water may be brackish. The Soela Islands likewise have perennial streams, some of which are spring-fed. Water in these springs is said to be badly polluted. In most places in the Amboina Archipelago rivers are numerous. Some are perennial. A few lakes are present. At one time, on Amboina Island, water was impounded by dams in the Batoegahjah and Batoegantoeng rivers. This supply may still be connected to the distribution system. Ceram has large rivers which run north or south, because of the mountain chain which traverses the island east to west. Several rivers in the northwestern part of Ceram disappear into cavernous limestone,

to become subterraneous streams for 2 or 3 miles before they reappear as springs. Boela, at the northeastern end of Ceram, obtains part of its water supply from a small river west of the town. Boeroe Island, west of Amboina and Ceram, has several mountain lakes, the largest of which, Wakollo, has an elevation of 3,500 feet. There are many small rivers; the only important one is Wae Apoe, or the Kajeli River. Extensive marshes are situated along the rivers. Generally, all areas in which the supply of surface water is deficient will nevertheless readily produce an adequate supply of ground water. The level at which ground water flows ranges from a few feet, along perennial streams, to 300 feet or more beneath the higher benches or hills. Some ground water is available as "perched" ground water. In the Banda Islands there are no rivers or brooks except on Lontar. In the Kai Islands, between the Banda and Aroe islands, surface water is found only on Great Kai, in the form of small streams on the eastern and western coasts. These streams dry up during the eastern monsoon. Along the coasts of several islands of the Little Kai group are extensive marshes.

(2) Wells. In the Batjan Islands wells are known definitely to exist only in Babang on the eastern coast of Batjan Island itself. Others doubtless are present. Primitive shallow wells are used for part of the water supply in the Soela Islands. Most inhabitants of the Amboina Archipelago obtain water from either shallow wells or sumps. The wells are the dug type, of large diameter. They are rarely more than 30 feet deep, and usually are sunk in alluvial deposits on the coastal plains. Water is raised by buckets and rope or some other primitive means. Some wells near the coast become dry at low tide; others yield brackish water. The city of Amboina obtains part of its water from a supply near Liangikan Grotto, about 2 miles south of the city. Wells probably constitute the supply, likewise, at the aerdrome at Laha and at the seaplane base at Halong, both on Amboina Island. On Saparoea Island adequate supplies probably can be obtained from wells placed far enough inland to avoid contamination by salt water, or from wells sunk deep enough to pierce the limestone of the lower terraces. On Ceram Island shallow wells as a rule produce adequate supplies of water, but drought occasionally occurs.

Many large coastal settlements obtain water from shallow wells, some of which are curbed with concrete. Boela, on the northeastern end of Ceram, has a supply obtained in part from drilled wells. Settlements on the coastal plain of Boeroe Island probably obtain water from dug wells which are rarely more than 30 feet deep. Water is raised by bucket and rope or other primitive means. Some shallower wells may become dry during periods of excessive drought. A few wells produce brackish water if pumped too heavily. At Namlea on Boeroe water is taken from shallow pits or wells sunk in the unconsolidated alluvial sediment underlying the town.

(3) Cold and thermal springs. Springs are numerous in the Batjan Islands; some are thermal. There are many springs in the Soela Islands; some of the streams are fed by springs. The town of Lekitobi at the southwestern corner of Taliaboe Island obtains a considerable part of its water supply from springs. Springs are found, likewise, in the

Amboina Archipelago. The city of Amboina on Amboina Island obtains part of its water supply from a spring 3 miles from the city. Thermal springs and springs which produce highly mineralized water are present on almost all the islands. In the northwestern part of Ceram Island some streams disappear into cavernous limestone to emerge, after 2 or 3 miles, in the form of springs. Many springs probably occur in many parts of Boeroe Island, west of Amboina and Ceram. Most of them, it would seem, are cold. Only two thermal springs are reported. In the Banda Archipelago the soil is loose volcanic material; springs do not occur there. There appear to be no springs, similarly, in the Kai Islands, and they are not reported from the Aroe Islands, easternmost of the Molukkas, or from the Tanimbar Islands.

(c) Water systems. In this area only three distribution systems are recorded: (1) in the town of Amboina on Amboina Island, (2) in the town of Boela on Ceram Island, and (3) in the town of Riring on Ceram. The system at Amboina in 1940 consisted of 14 miles of 12-inch pipe; it supplied 516 private consumers, 38 commercial establishments, and 6 public hydrants, with a total volume of 50,800,000 gallons. Water was piped to the main pier and to the coal jetty, where it could

be supplied at the rate of 7 tons (1,680 gallons) per hour. Little is known of the distribution systems in Soela and Riring, other than that they were in existence before the Japanese invasion.

(d) Purification. The only place in this area at which purification was carried out was the city of Amboina on Amboina Island. Water taken from a well near Liangikan Grotto 2 miles south of the city, and from a spring 3 miles from the city in Koesoe-Koesoeserah, was treated with caporite before it was delivered to the distribution system.

(e) Quality. In the Batjan Islands surface water generally is low in mineral content but high in organic products, with decided color and unpleasant odor and taste. Ground water is hard when it is taken from limestone areas, but otherwise is not highly mineralized. Water in the streams in the Soela Islands is badly polluted; water in springs usually is somewhat safer, but at times may be contaminated. Properly located and constructed drilled or dug wells in the coastal areas should yield water of satisfactory quality in adequate amounts. Water from shallow wells is polluted. It is said that surface water in mountain sources in the Amboina Archipelago is not polluted, and that when such water reaches the coastal areas it is still relatively uncontaminated.

Water from springs in this particular archipelago is likely to be strongly mineralized. Water from wells near the coast is likely to be brackish; almost all such water is polluted. All water on Ceram Island is considered to be unsafe; surface water is contaminated, to some degree, by fecal matter. Surface water on Boeroe Island is low in mineral content, turbid during the rainy season, and relatively clear during the low-water stage. Often it has a decided color and taste because of the dissolved and suspended organic matter. Water from wells too near the sea is brackish; all well water on the island probably is highly contaminated. Water in some parts of the Aroe Islands is unpalatable; this is true likewise in the Tanimbar Islands.

B. Sewage.

(1) Celebes (north to the equator).

Some of the houses of the Occidentals and wealthier Chinese have cesspools or septic tanks. The rest of the people have no provisions for the sanitary disposal of wastes. The result is that intense pollution of the soil prevails around dwellings. In many areas even the simplest type of privy is unknown.

(2) Islands other than Celebes.

Water-carriage sewerage systems do not exist in these islands. Some Occidental dwellings have cesspools or septic tanks, the construction of which often is faulty. The most cleanly natives deposit excreta on the beach or on a reef for removal by the ocean. Children, however, and often adults, pollute the soil around the houses and trust that animal life will effect disposal. This results in highly undesirable and offensive conditions until tropical showers clean such villages and their surroundings. It has been impossible to teach the natives to use latrines. Usually, they are willing to build a latrine, if persuaded or forced by the authorities to do so, but they will use it only as long as careful supervision is maintained. As soon as supervision is relaxed, the latrine is forgotten. General sanitary conditions in the cities and villages in this area are unsatisfactory. Even in Amboina, by far the largest city in the region, a large garbage dump in the outskirts of the city caused bad odors, and was one of the reasons why flies and rats were exceedingly abundant about 1938.

C. Animals.

The area of this survey represents a transitional zone between Asiatic and Australian fauna. In general, species found in Celebes and the western Molukken Islands are predominantly Asiatic; those in the eastern Molukken Islands and the islands of the eastern part of the Banda Sea are predominantly Australian. In the central part of the area very striking differences may be found in the fauna of contiguous island groups.

(1) Vectors of disease.

(a) Mosquitoes.

(1) Anopheles. At least 15 different anophelines are found in Celebes alone (Table XI-C).

Those anophelines which are found in both Celebes and the islands of the eastern Banda Sea are Anopheles barbumbrosus, A. hyrcanus nigerrimus, A. maculatus maculatus, A. minimus minimus, A. parangensis, A. subpictus subpictus, A. sundaicus, A. tessellatus, A. umbrosus and A. varus varus. Species reported from Celebes alone, or Celebes and the islands about southeastern Celebes (Table XI-C), are Anopheles aconitus, A. barbirostris barbirostris, A. aitkenii aitkenii, A. karwari, A. kochi, A. leucosphyrus hackeri and A. leucosphyrus leucosphyrus.

So far as Celebes is concerned, the important vector of malaria in the southern coastal areas, where the sea has formed salt-water lagoons, is Anopheles sundaicus. In such locations A. subpictus subpictus also will transmit malaria, but recent investigation has shown that in southern Celebes, as in other regions, A. sundaicus is a much more active vector than A. subpictus subpictus. Anopheles sundaicus breeds chiefly in brackish waters. This fact has been used to distinguish it from the closely related A. ludlowii, which breeds in fresh water. Anopheles sundaicus is found, as a rule, in coastal accumulations of stagnant saline waters, including not only lagoons but also fishponds and similar collections. Such bodies of water are partly or wholly protected from tidal fluctuations. Since the larvae of A. sundaicus prefer sunlit waters, breeding usually does not occur in mangrove swamps, which are shaded. The presence of algae, however, favors breeding. Anopheles barbirostris barbirostris, ordinarily regarded as a vector of limited importance, recently has been found to have a high rate of natural infection in the interior of southern Celebes. It transmits filariasis as well as malaria. In some areas A. barbirostris barbirostris has been found to be the sole vector of malaria; in others it has been found to be a vector in association with A. hyrcanus (nigerrimus?). Both these species have a high index of

infection. Anopheles barbirostris barbirostris breeds by preference in shaded, vegetated, stagnant waters, in rice fields, swamps and fish-ponds. Anopheles hyrcanus nigerrimus likewise breeds in rice fields, swamps and other collections of still or slowly moving water protected by vegetation. In the Netherlands East Indies A. hyrcanus nigerrimus exhibits a marked preference for the blood of man, and it enters houses there readily.

Anopheline mosquitoes, together with the names of those islands of the eastern Banda Sea on which they occur, are listed in Table XI-9. Potential carriers of malaria in this general area are Anopheles punctulatus moluccensis, A. punctulatus punctulatus, A. subpictus subpictus, A. barbumbrosus, A. kochi, A. varus varus, A. umbrosus, and A. sundaicus. Anopheles ludlowi, apparently distinct from A. sundaicus, has been found on Ceram Island. Vectors of malaria in this general area tend to be those species usually classed as Australian.

Anopheles punctulatus punctulatus has been described from all the Molukken Islands. It is a dangerous vector of Wuchereria bancrofti as well as of malaria. Anopheles punctulatus moluccensis is found in most of the Molukken Islands and eastern islands of the Banda Sea. Wherever it occurs, it probably is a very important vector of malaria. It is also a dangerous vector of Wuchereria bancrofti. Anopheles subpictus subpictus

has been reported from almost all the Molukken Islands. Anopheles kochi has been observed in many of the Molukken Islands, and possibly on Aroe Island. In the Molukken Islands A. sundaicus has been described only from the Batjan Islands (Table XI-9). It shows constant differences from the typical A. ludlowii of the Philippine Islands which, in the Netherlands East Indies, is, as far as is known, limited to Ceram (Table XI-9).

Anopheles umbrosus in the Molukken Islands has been reported only from Boeroe (Table XI-9). The only place in this area from which A. maculatus maculatus has been reported is the Aroe Archipelago; the accuracy of even this report is not certain (Table XI-9).

So far as individual islands are concerned, it has been possible to identify some species of Anopheles as being particularly dangerous in certain locations. Thus, on Amboina Island the highly dangerous A. punctulatus moluccensis will breed not only in sweet water, but also in brackish pools. The species found most often on the island are A. punctulatus punctulatus, A. kochi, A. barbumbrosus and A. vagus vagus. The species found most often in the city of Amboina are A. punctulatus moluccensis, A insulaeflorum and a few A. subpictus subpictus. Anopheles punctulatus moluccensis and A. insulaeflorum are especially likely to enter houses. On Saparoea and Noessalaoet in the Amboina group both A. punctulatus

punctulatus and A. barbumbrosus are common. On Halmahera, in this group, the same anophelines are found, with the addition of A. subpictus subpictus. On Ceram Island the chief vectors of malaria are A. punctulatus punctulatus and A. punctulatus moluccensis; possible vectors there are A. subpictus subpictus, A. barbumbrosus and A. vagus vagus. Moreover, A. ludlowii (sundaicus?) has been caught near Piroe on Ceram, the only place in the Netherlands East Indies where this species has been observed (Table XI-9).

(2) Seven different species of Aedes mosquitoes have been described from Celebes (Table XI-10). Aedes aegypti and A. albopictus, the two vectors of dengue fever, are widespread. Aedes aegypti is a domestic mosquito. It breeds in small collections of water, and especially in artificial collections, such as are formed in tanks, roof gutters, flower vases, or tin cans. The two species of Mansonia found in Celebes--Mansonia annulata and M. longipalpis--can carry Wuchereria malayi, but are less efficient vectors of this parasite than is Anopheles barbirostris barbirostris. Aedes scutellaris, which is a vector of Wuchereria bancrofti in the Fiji Islands, is widely distributed in the Molukken Islands and eastern part of the Banda Sea. It breeds in such sites as brackish water, crab holes, puddles in coral reefs, and depressions in old lava flows. Aedes vigilax, said to be

islands. It breeds in fresh, brackish or even undiluted sea water. If the wind is favorable, adult mosquitoes can be carried as far as 10 to 20 miles, or, in rare cases, 40 to 50 miles. This mosquito is anthropophilic in Australia, but seems not to be so in the Netherlands East Indies. None of the Mansonia mosquitoes are known to be vectors of Wuchereria bancrofti in the Netherlands East Indies. In Table XI-11 are listed the culicine mosquitoes of the Molukken Islands and islands of the eastern Banda Sea.

(3) Eleven different species of Culex have been reported from Celebes alone (Table XI-10). Culicine mosquitoes reported from the islands of Boetoeng and Kabaena, off the southeastern coast of Celebes, are listed in Table XI-12. Several important species of Culex occur in the Molukken Islands and islands of the eastern Banda Sea (Table XI-11).

Culex quinquefasciatus (fatigans) is widespread in the Molukken Islands. It breeds near dwellings. The larvae have been found in all sorts of artificial accumulations of water, such as tanks, wells, pits, water barrels, toilets, fountains, cisterns, ponds, springs, canals and ditches. Stagnant water is preferred. The larvae can withstand a salt concentration of 0.1%. This species does not occur in jungles and uninhabited areas.

In Ceram, however, it has been observed only near the harbors and is evidently of recent importation. Culex quinquefasciatus, which in most places of the world is the most active vector of Wuchereria bancrofti, is not an important vector in any part of the Netherlands East Indies. It is least efficient in the eastern part of the archipelago. In New Guinea it has even been impossible to infect C. quinquefasciatus artificially. In the Molukken Islands it has been found naturally infected but only to a very slight degree.

Culex vishnui has been reported only from Amboina Island. This mosquito breeds in various types of places, such as lakes, backwaters, small streams, drainage ditches, flooded grasslands, and irrigation water on rice fields or lagoons. It breeds infrequently in brackish water. The adults are anthropophilic and begin biting as soon as the sun sets.

Experimental infection and complete development of larvae of Wuchereria bancrofti have been obtained in C. fuscocephalus, C. whitmorei, C. annulirostris, C. tritaeniorhynchus, and C. sitiens. None of these species has been found naturally infected.

(b) Lice. Pediculus humanus capitis, the head louse, is of frequent occurrence in Celebes, but the body louse, P. humanus corporis and the pubic louse, Phthirus pubis, are rare. It is reported generally that lice are numerous in the Molukken Islands and the islands of the eastern Banda Sea. These lice presumably are Pediculus capitis, since as a result of the scantiness of clothing among the natives, Pediculus corporis and Phthirus pubis probably are rare.

(c) Flies. Musca conducens, M. ventrosa, M. vetustissima and M. xanthomelas have been reported from Celebes. Others are Hemipyrellia ligurriens, Lucilia papuensis, Calusa indica and Chrysomyia megacephala. It seems probable that most of the flies of Java would also be found in Celebes. Therefore, Musca sorbens, M. crassirostris, M. planiceps, and M. corvina can also be expected, together with Orthellia chalybea. In the harbors which have regular contacts with the outside world, occasional specimens of M. domestica may be found. Of the bloodsucking flies, Tabanus atrimaculatus, T. factiosus, T. ceylonicus, T. flexilis, T. humillimus, T. immixtus, T. perimmixtus, T. reducens, T. speculum, T. malayensis, T. fumifer, T. fuscicauda, T. immanis, T. inaequeannulatus, T. indianus, T. rufiventris, T. striatus, T. xanti, T. optatus, T. rubidus, T. succurvus, T. spoliatus and T. fusconaculatus unisignatus have been described.

Chrysops dispar, C. fasciata, C. fixissima, C. flaviventris, and C. signifer also occur. Chrysozona ciugulata, C. irrorata, C. javana, C. pungens, and the rare Lissimas moestus, L. fenestratus, Neobolbodymia argentata and N. laticornis have been reported. Silvius celebensis occurs. Large numbers of Phlebotomus perturtans and P. angustipennis may be expected on Celebes. Although they do not play a role as vectors of disease in this area, they may be exceedingly disagreeable because of their numbers.

In the Molukken Islands and the islands of the eastern Banda Sea, careful investigation on Boeroe Island have revealed the presence of Musca nebulo, M. sorbens, M. ventrosa, M. vicina (probably a variety of M. domestica), M. vetustissima, Graphomyia maculata, Orthellia diffidens, and Morellia sp. Of the Calliphoridae Chrysomyia megacephala was found, and of the biting midges, Culicoides pungens.

No special surveys of the species of Simulium of the Molukken Islands are available, but up to 1935, 18 different species had been reported from Java and Sumatra. Of the tabanid flies, Tabanus extricans and T. insurgens have been found in the Batjan Islands; T. ceramensis, T. cohaerens, and T. obscuratus in Ceram; T. obscuratus in Amboina; T. brunneothorax; T. ceylonicus, T. flavipennis, T. reducens, and T. succurvus in Boeroe;

T. aroensis, T. caesius, T. recusans, T. rufinotatus, and T. wollastoni in the Aroe Islands. Chrysops signifer has been reported from the Batjan Islands and from Boeroe; C. atrivittata from Boeroe, and Pangonia amboinensis from Amboina.

(d) Mites and ticks. Unfortunately, the information available about the mites of Celebes is unsatisfactory. In view of the occurrence of mite-borne typhus on this island, more complete data would be highly desirable. Of the mites which attack man, Trombicula pseudo-akamushi has been found on Celebes, but no reports have been found on the occurrence of T. deliensis, the vector of mite-borne typhus in the Netherlands East Indies. Sarcoptes scabiei is common. The ticks Boophilus annulatus and Rhipicephalus haemaphysaloides have been described from Celebes. The latter species occurs especially in southwestern Celebes and in the central part of western Celebes. Chiggers abound in the jungles and the woods. Boophilus annulatus has been reported from the Soela Islands, Ceram Island, the Amboina Archipelago, Saparoea Island, and the Tanimbar group, all in the Molukken Islands and islands of the eastern Banda Sea. Rhipicephalus sanguineus is known to occur on Saparoea Island and the Amboina Archipelago. Ixodes holocyclus occurs in the Kai Islands. The itch

mite, Sarcoptes scabiei, is one of the most frequently occurring parasites of human beings in the Molukken Islands. At least a score of other mites have been reported. One should assume that mites capable of spreading mite-borne (scrub) typhus, and perhaps already infected, will be found throughout this area, even though specific data are lacking at present. In the jungle, chiggers may be a real pest.

(e) Fleas. Pulex irritans has not been described from Celebes, but Xenopsylla cheopis, X. astia, Ctenocephalides canis, and C. felis all occur. The two species of Xenopsylla have been found in large numbers on the rat population of Makassar and neighborhood. In the Molukken Archipelago and islands of the eastern Banda Sea, as in Celebes, Pulex irritans is rare. This flea does, however, occur in New Guinea, to the east, so that it might be present in some of the easternmost islands.

(f) Rodents. In Makassar, on Celebes, Rattus norvegicus and R. concolor are by far the most frequently occurring rats. Rattus diardii, the house rat, is less prevalent. In this city R. concolor has replaced R. diardii as house rat. In the fields R. brevicaudatus is found in large numbers. From southeastern Celebes R. hoffmani and different

species of the Chrysocomys, Xanthurus, and the R. hellwaldii rajah group have been described. Rats are very common in the Molukken Islands and islands of the eastern part of the Banda Sea. They belong, in general, to the Rattus rattus and R. concolor group. On Ceram Island R. ringens has been encountered. In the Batjan Islands R. hoffmanni has been found. From the Kai Islands Uromys siebersi has been reported; U. aroensis is known to be present in the Aroe Islands.

(2) Dangerous animals. Poisonous snakes in Celebes are the common krait, Bungarus candidus; the hooded cobra, Naja naja; the red-tailed snake, Doliophis intestinalis; and a viper, Lachesis wagleri. No poisonous snakes have been reported from the Boetoeng group. In the sea around Celebes, poisonous sea snakes are Platurus colubrinus, Hydrus platurus, Hydrophis brugmansi, and the small water snake, Enhydris hardwickei, which is mildly poisonous. Two large pythons are present in Celebes: Python reticulatus and P. molurus. Python molurus is dangerous only if it is attacked. Ordinarily, it has a placid or even sluggish disposition.

The scorpions of Celebes are only slightly poisonous. Hormurus australasiae, Chaerilus variegatus, and C. celebensis can be expected. Crocodiles are numerous. The babirusa, Babirussa babirussa, a wild boar with dangerous tusks, is native to Celebes.

In the islands of Celebes, a poisonous snake, Acanthopis antarcticus (the death adder), occurs in most of the southern Molukken Islands but not in Amboina. In addition, Pseudelaps mulleri is found in Ceram. In Amboina and many other Molukken Islands, five snakes occur. These are Cerberus rhynchops, Fordonia leucobalia, Dipsadomorphus drapiezii, D. irregularis, and Chrysopelea rhodopleuron. These species are probably not dangerous. Nine poisonous sea snakes live in the seas near the Molukken Islands: Platurus colubrinus, P schistrohynchus, P. laticaudatus, Hydrus platurus, Hydrophis belcheri, H. elegans, H. ornatus and H. fasciatus atriceps, and Aipysurus laevis.

There are also many nonvenomous snakes, the most dangerous of which are two pythons, Python reticulatus and P. amethystinus, both reported from Ceram Island.

Crocodiles are frequent in all parts of the area.

Other dangerous animals are rare in the Molukken Islands. Two types of viverrids (wildcats) have been described.

Poisoning caused by the eating of Tetraodontidae (puffer fish) occurs occasionally. The largest concentration of the poison of these fishes is present in the ovaries and testes; it is not destroyed by cooking. Injuries inflicted by fishes that have spines attached to

poison glands, especially Synancea verrucosa (the warty scorpion fish), may give rise to dangerous inflammation of hands or feet.

The sting of the scorpions of the Molukken Islands causes local signs, which soon disappear. In Amboina Isometrus maculatus, Lychas mucronatus and Hormurus australasiae occur. In the other islands, Hormurus weberi, H. caudicula and H. karschi are also found.

(3) Pests. Many flies, mosquitoes and other insects which do not carry disease are annoying pests in this area. The bedbug, Cimex lectularius, occurs in large numbers on Celebes. Land leeches are very common in the forests, and must be guarded against. Some of these leeches can penetrate the eyelets in shoes or leggings.

D. Food.

In the greater part of Celebes rice is the staple food. Rice, however, usually is not planted on irrigated fields, but on dry soil, where its development depends upon sun and rain. Corn is grown in the hills, where it forms a main part of the people's diet. Sago woods are present in marshy areas. In Kendari, for instance, the people depend chiefly upon sago and fish. Sago is a dry, granulated or powdered starch, prepared largely from the pith of a sago palm such as, in this area, the gebang, Corypha gebanga or Metroxylon laeve or M. rumphii. It is made into a pudding by being boiled in water or milk. Habits in

respect to food of course vary according to region and the products of the region. The chief domestic animal of the area is the carabao or water buffalo, Bubalus bubalus.

In the Molukken Islands the staple food is sago, which is low in proteins, low in fats, and practically devoid of vitamins. For many years it had been assumed that the natives, if left to their own devices, would escape the dangers of severe nutritional deficiency by supplementing their sago diet with animals caught in the woods and with fish. Nowadays, there is good reason to consider this statement overoptimistic. It is certain that contact with western civilization usually has had a bad influence upon the general nutrition in this area, because Occidental habits or customs may induce the natives to abandon their customary diet, which includes caterpillars, maggots and other animal foods rich in proteins and vitamins.

In the Amboina Archipelago, sago is the principal food, but there are not sufficient crops to satisfy the needs. Every year large groups of the inhabitants of the Amboina Archipelago cross to Ceram Island to cut down the sago trees at the southern coast around Elpapoetih Bay, near Makariki. In addition to sago, a large amount of fish is eaten. The Christian inhabitants of Amboina and Saparoea also eat rice; the Moslems a certain amount of corn. The nutrition of the urban peoples is worse

than that of those in the country, since in the city much money is spent for tuition fees and for western clothes, and often not enough is left for food.

Cattle are very scarce in Amboina. The Moslems have some sheep and goats; the Christians, pigs. The amount of poultry is small. The Ambonese do not engage extensively in agriculture. The 3,000 Boetonese who have migrated to Amboina and live in the mountains have large gardens and sell their produce. These people are completely uncivilized and extremely dirty.

An alcoholic beverage obtained from the flowering tops of the palm, Arenga saccharifera, is consumed in great quantities throughout the Molukken Islands. The juice from these flowering tops, the so-called palm wine, is fermented after the addition of bitter roots. From this fermentation the popular saroweer or sageroe results. Use of this wine is very common in the western part of Ceram Island. One of the centers for this type of addiction is the village around Piroe, where the men retire regularly into the forests in order to enjoy their alcoholic intoxication without interference. The chewing of sirih, or betel, is common among the older natives. The nut of the betel palm, Areca catechu, wrapped with a little lime in leaves of the betel palm, is chewed. The nut contains, in addition to tannin and other substances, six alkaloids, all of which

are derivatives of pyridine. Addiction to opium is rare in this area, but has been reported from the southeastern part of Ceram Island.

Recent reports indicate that the Japanese, in many areas included in this survey, seized cattle and foodstuffs like rice. On Selaroe Island in the Tanimbar group, for instance, the inhabitants were permitted to produce sago until June, 1944; shortly after that date the effects of the Allied blockade became serious. Each ripe sago palm was then marked in such a way as to identify it as the property of the Japanese army. Production of sago continues as a monopoly of the Japanese army. The natives have continued to subsist on a substitute of poor quality, probably made from Corypha gebanga or Arenga saccharifera. After it became impossible to import food into Selaroe Island in 1944, both the Japanese garrison and the natives have become undernourished. Diseases of the skin and beriberi are prevalent. The inability of the Japanese to supply food for local laborers has forced them to rely solely on hei-ho or auxiliary troops, for labor. The Japanese have developed extensive vegetable gardens, but also have taken vegetables from the gardens of the natives. Elsewhere in the Molukken Islands and islands of the eastern Banda Sea, undernourishment is said to be common, particularly in concentration camps to which native peoples have been sent to work for the Japanese. It is said that anemia

and deficiency of vitamin B are common, and that some natives have died of "simple exhaustion".

112. Public Health and Medical Facilities.

A. Public health organization.

(1) Celebes (north to the equator). Most of that part of Celebes concerned in this survey was included in the residency of Celebes and its dependencies, with Makassar as capital.* To this residency belonged the Selajar Islands off southern Celebes, the Banggai Islands east of Celebes, the Toekangbesi Archipelago off southeastern Celebes, and the islands of Boetoeng, Moena, and Kabaena. The islands of Boetoeng, Moena, and Kabaena and the Toekangbesi Archipelago, together with the counties of Poleang, Roembia, and Laiwoei of the southeastern peninsula, constitute the administrative district of Boetoeng and Laiwoei, with capital at Kendari and a total population of 310,500 persons.

In Makassar there was a chief public health physician. This official, together with the chief of the Public Health Services of the Molukkas in Amboina, was responsible to the Inspector of the Public Health Service located in Makassar. The latter reported immediately to Batavia, capital of the Netherlands East Indies.

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*Celebes had two residencies: Celebes and Manado. The residency of of Manado is outside the geographic limits of this particular survey.

In Celebes, as in other parts of the Netherlands East Indies, the Public Health Service was inseparably interwoven with the curative functions of the government physicians. Areas of this character had virtually no medical service other than that furnished by the government. Consequently, the medical officer acted both as health officer and as physician to the territory he served. Other medical personnel, nurses, vaccinators, and midwives served under his direction.

In the residency of Celebes and dependencies, the medical personnel of the Public Health Service consisted of 4 European physicians, 11 Indonesian physicians, 1 civilian physician who performed public health duties, 5 military physicians who, in addition to their military duties, acted as public health physicians, 1 European nurse, 40 Indonesian nurses, 38 vaccinators, 1 midwife, and 2 technicians (Table XI-13). One of the physicians of Makassar was director of the Regional Central Laboratory, and one was director of the psychopathic hospital, and one was the consulting ophthalmologist of the Public Health Service.

(2) Islands other than Celebes. The Molukken Islands and the islands in the eastern part of the Banda Sea are included, for purposes of public health and medical service, in the residency of Molukka. This residency also includes Dutch New Guinea, which is not in the area encompassed in this survey, and a group of islands northeast of Timor (Southwestern Islands), which are included in the present survey.

The residency of Molukka consists of five districts. Two of these districts--northern New Guinea and western New Guinea--do not fall within the geographic limits of this survey, and will not be detailed herein. The other three districts are subdivided as follows.

1. District of Amboina.

   (a) Amboina--Administrative Post Amboina.

   (b) Saparoea--Administrative Post Saparoea.

   (c) Banda--Administrative Post Banda.

   (d) Boeroe--Administrative Post Namlea.

   (e) East Ceram--Administrative Post Ceser.

   (f) West Ceram--Administrative Post Piroe.

   (g) Wahai (Ceram, northern coast)--Administrative Post Wahai.

   (h) Amahai (Ceram, southern coast)--Administrative Post Amahai.

2. District of Ternate.

   (a) Ternate--Administrative Post Ternate (not included in the geographic area of this survey).

   (b) Soela Islands--Administrative Post Sanana.

   (c) Batjan Islands--Administrative Post Laboeha.

   (d) Djailolo (Halmahera)--Administrative Post Djailolo (not included in the geographic area of this survey).

   (e) Weda (Halmahera)--Administrative Post Weda (not included in the geographic area of this survey).

   (f) Tobelo (Halmahera)--Administrative Post Tobelo (not included in the geographic area of this survey).

3. District of Toeal.

(a) Kei Islands--Administrative Post Toeal.

(b) Aroe Islands--Administrative Post Dobo.

(c) Taninbar Islands--Administrative Post Saumlakki.

(d) Southwestern Islands--Administrative Post Wonreli (on Kisar Island).

(e) Upper Digoel--Administrative Post Tanahmerah (not included in the geographic area of this survey).

(f) South New Guinea--Administrative Post Merauke (not included in the geographic area of this area).

The chief of the Public Health Service of the Molukken Islands resided in the city of Amboina. As said previously, he was responsible to the public health inspector at Makassar in Celebes. The latter reported directly to the Chief of the Central Public Health Service in Batavia. It is known that in 1938 a physician was stationed at all the administrative posts listed in the previous paragraph. These physicians were responsible both for medical care and for promotion of public health, functions which in this area were inseparable. In most places where a physician was stationed, a mantri (graduate Indonesian male nurse) was also located (Table XI-14).

Every subdivision had one or more vaccinators (Table XI-14). East Ceram had two vaccinators, one for eastern Ceram proper, the

other for the adjoining islands. In western Ceram one was stationed at Piroe and one at Riring. There were two in the Tanimbar Islands, one of whom was in Larat, the other in Saumlakki.

Every government physician was obliged to make a monthly inspection trip lasting 10 to 14 days. On these trips spleen indices and parasite indices were ascertained, mosquitoes were captured, and breeding places were sought. In most areas the conveyance used for these tours of inspection was a proa; occasionally a larger ship was available. The trip often had to be interrupted because of the weather, and in certain seasons inspection trips were impossible. During such trips a mantri directed the hospital of the area.

(3) Scope and estimate of effectiveness. In view of the vastness of Celebes (76,000 square miles), the size of the population (more than 4,200,000 inhabitants), and the difficulties of communication and transportation, the medical personnel of the Public Health Service can hardly have been sufficient to cope with the most essential duties. It is likely that the general situation in the Molukken Islands and islands of the eastern Banda Sea was even less satisfactory than that in Celebes.

B. Hospitals and medical institutions.

(1) Hospitals.

(a) Celebes (north to the equator). In the residency of Celebes there were 32 general hospitals with 1,015 beds (Table XI-15). One of

these was located on Salajar island, one on Boetoeng, and one on Moena. Many of these hospitals were small and unsatisfactorily equipped. The military hospital in Makassar, to which civilian patients were also admitted, was satisfactorily equipped, as were a few of the smaller new hospitals, as for instance, the hospital in Parepare.

In addition, there were 7 leprosaria in Celebes (Table XI-15). A psychopathic hospital with 305 beds was located in Makassar.

Outpatient clinics were widely scattered throughout the island.

On the basis of reports received in 1945, it is believed that many hospitals still have Indonesian staffs, with Japanese officials in supervision. In many places, however, no medicine is available for the native peoples.

(b) Islands other than Celebes. There were 17 hospitals with more than 500 beds in those Molukken Islands and eastern Banda Sea islands situated in the geographic area included in this survey. Most of the hospitals were small and poorly equipped (Table XI-16). In Amboina the large military hospital also served the civilian population. In addition, there were 5 leprosaria, the largest and best equipped of which was in Amboina (Table XI-17).

The care of mental disease was completely neglected. In the military hospital in Amboina, five cells existed where psychopathic patients could be isolated, at least if they did not become too noisy.

The rest of the mental disease patients of this whole area were kept in prison until they could be transported to one of the special hospitals for mental diseases in Java. The average stay of such patients in prison was 4 months, but occasionally they had to remain for a whole year before transportation could be obtained.

The drug supply in these remote posts was a complicated one. Most of these little villages were visited only once a month by a steamer. Often drugs had to be rushed by plane from Amboina or even from Batavia to remote outposts when epidemics broke out.

A report received in 1945 indicates that in liberated areas contiguous to the region concerned in this chapter, the Japanese systematically sacked existing hospitals and seized both medicines and instruments. In some places neither hospitals nor dispensaries remain. In most places no physicians are to be found, but Indonesian male and female nurses have not been disturbed. These conditions probably obtain throughout the area included in this chapter.

(2) Other institutions.

(a) Medical schools. There were no medical schools in Celebes, the Molukken Islands or the islands of the eastern Banda Sea.

(b) Laboratories. A well-organized and well-directed regional laboratory was located at Makassar in Celebes. In 1938 this laboratory

examined 42,300 specimens, only one-third of which were sent from the city of Makassar proper. The work consisted of bacteriologic cultures, microscopic examination of specimens of blood and stools, serologic tests, examination of arthropods and rodents, and examination of water and food.

Amboina had a special malaria laboratory where blood smears were checked and mosquitoes were identified. Reports were forwarded to the government physicians who had sent the specimens. Three mantris worked in this laboratory. The nearest general diagnostic laboratory was at the aforementioned Makassar in Celebes. In 1938 the physicians at Laboeha in Batjan (a focus of dysentery) were reported to be equipped with a stock of glycerin tubes in which specimens could be sent to Makassar. Wassermann tests were performed in the military hospital at Amboina. Laboratory facilities in other parts of the Molukken Islands and islands of the eastern Banda Sea probably did not exist, or, if they did, must have been elementary. It is known that the Japanese have seized instruments, laboratory equipment, and other laboratory apparatus. In some cases buildings have been destroyed.

(c) Clinics. In the Molukken Islands and islands of the eastern part of the Banda Sea, clinics independent of hospitals were found at Amboina, Larat (Tanimbar Islands), Saumlakki (Tanimbar Islands, and Toeal

(Kai Islands). In addition, there were several clinics where practical nurses acted as dispensers and where a government physician occasionally came for a check-up. Such clinics were found in Laiwoei (Batjan Islands), Toelehoe (Amboina), Leinator (Saparoea), and Honitetoe (western Ceram). The problem of medical care in the Tanimbar Islands offered peculiar difficulties because of bad weather conditions.

C. Medical Personnel.

(1) Physicians. Almost all the physicians in Celebes belonged to the Public Health Service (Table XI-13). One public health physician was located at Baosbaoe on Boetoeng, and one at Raha on Moena Island. Both were responsible to the inspector of public health at Makassar. Three European physicians and four Indonesian physicians practiced in Makassar. Outside of Makassar the physicians not connected with the Public Health Service were missionaries working in small hospitals.

In the Molukken Islands and islands of the eastern part of the Banda Sea, medical care was furnished by government public health physicians, assisted by native mantris and vaccinators. Table XI-14 shows the reported location of such personnel in 1938.

In Amboina on Amboina Island the military physician acted at the same time as physician of the Public Health Service. His task was so extensive that he could take care only of the city of Amboina, with the result that the Public Health Service of the rest of the island was

neglected. A second government physician in Amboina acted as head of the leprosy campaign and as director of the leprosarium of Amboina, but was not permitted to give any time to problems not directly connected with leprosy. There was also a physician attached to the oil company at Boela on Ceram Island.

It has been reported that in areas liberated from the Japanese, and contiguous to the region included in this chapter, physicians have not been found. Presumably, the Japanese took the physicians with them as they retreated.

(2) Dentists. In Makassar on Celebes two dentists were known to have been in practice. The number of dentists in the Molukken Islands and islands of the eastern Banda Sea is not known.

(3) Nurses. In Celebes, in addition to the nurses mentioned in Section 112, part A (1), a few Europeans worked in Makassar as private nurses. It seems reasonable to surmise that in the missionary hospitals, nurses not mentioned among the public health personnel were also working. The location of Indonesian nurses or mantris in the Molukken Islands and islands of the eastern Banda Sea is shown in Table XI-14. Practical nurses were found at some of the clinics situated in these islands. The Japanese apparently have not disturbed either male or female Indonesian nurses.

(4) Midwives. In the residency of Celebes 6 midwives practiced privately. Only one midwife was listed as being attached to the Public Health Service. The number of midwives in islands other than Celebes is not known. Doubtless there were many native midwives throughout the entire region.

(5) Others. In Celebes, a pharmacist was located at Makassar. In all other cities and villages on this island physicians performed the duties of pharmacists. Thirty-eight vaccinators and 2 technicians were attached to the Public Health Service in Celebes. It is seen in Table XI-14 that there were 18 vaccinators and 15 Indonesian nurses or mantrig in the Molukken Islands and islands of the eastern part of the Banda Sea. A mantri was a graduate male nurse, but actually could be called upon to do many things other than nursing. Some acted as dispensers; others took the place of the physician at some station when the physician chanced to be called away. Probably they have not been interfered with by the Japanese.

113. Diseases.

A. Diseases of military importance.

(1) Celebes (north to the equator).

(a) Malaria. Celebes is a highly malaricus island. There are only a few places in which malaria does not occur or in which it is rare. In recent years, the city of Makassar has been practically free of malaria. The southwestern arm of Celebes was devastated by serious epidemics almost every year. In 1936 such an outbreak was reported from Boelookoemba, Sindjang, Watampone, and Loewoek. In 1937 Watampone and Djeneponto were seriously affected; in these areas the parasite index rose to 70 per cent. In many villages of Bira the parasite index was 100. The southeastern arms and the central part (Toradja area) of Celebes are also notoriously malaricus.

Information obtained early in 1945 indicates that in the Netherlands East Indies generally the Japanese have not maintained the practice of the Dutch government in respect to control of malaria; that is, irrigation, oiling, use of larvivorous fish, temporary drainage, and eradication of breeding places have not been carried out. It is said that the earlier estimate that 5 per cent of the people in this region have malaria is now far too low. Many natives,

it would appear, receive no treatment from the Japanese if they contract malaria. Malaria and bacillary dysentery are reported to have been the chief causes of death among the natives during the Japanese occupation.

The vectors of malaria differ in different areas of Celebes. In southwestern Celebes it had always been thought that Anopheles subpictus subpictus was the anopheline that transmitted malaria. In recent years new data have been collected which would indicate that A. sundaicus is a much more important vector in this area than is A. subpictus subpictus. In many parts of the coast of Celebes, salt-water lagoons are favorite breeding places for A. sundaicus. In 1938 in Djeneponto, 2.5 per cent of the A. subpictus subpictus examined were naturally infected with malaria, whereas 54 per cent of A. sundaicus were infected.

In southwestern Celebes A. barbirostris barbirostris has recently been proved to be an important vector. Until a few years ago it was not believed to play an outstanding rôle in the transmission of malaria. Anopheles barbirostris barbirostris had been found to be naturally infected only in a few areas of Sumatra (Kisaran on Sumatra's east coast and Groot Mandailing in Tapinnoeli), but even in these regions the rate of natural infection was very low (0.36 and 0.55 per cent).

Then, in 1938, in three different epidemics in southwestern Celebes, A. barbirostris barbirostris was shown to be the main vector. In the Javanese immigration colony of Wonoredjo near Malekoe in Malili, it was the only vector and was found to have a rate of natural infection of 13 per cent. In Boetoeng near Parepare the rate of natural infection was found to be 11 per cent. Here, however, A. barbirostris barbirostris was not the only vector, because A. hyrcanus nigerrimus showed a rate of natural infection of 8.7 per cent. The people affected in this area consisted of laborers imported from parts of southwestern Borneo. South of Lake Tempe in Singkang in Watampone, during an epidemic of malaria among the local population, the only infected mosquito was A. barbirostris barbirostris, but the rate of natural infection in this area was only 1.6 per cent. Finally, in 1939, A. barbirostris barbirostris was the vector in epidemics in Bonthain and Boelcekoemba. In all these areas in Celebes A. barbirostris barbirostris attacks man with great ferocity. Whereas in the rest of the Netherlands East Indies A. barbirostris barbirostris prefers the blood of cattle, it is strongly anthropophilic in Celebes. It has been stated that slight morphologic differences exist between A. barbirostris barbirostris found in southwestern Celebes and A. barbirostris barbirostris found in the rest of the Netherlands East Indies. Information about vectors of malaria in the rest of Celebes

is much less specific. The incidence of malaria in many other areas, including parts of the southeastern peninsula and the interior, is, however, as high as that in southwestern Celebes.

On Boetoeng Island the people avoud the northern part of the area because of the frequency of fevers there, yet malaria seems to occur almost as often in the southern part. In 1922 the splenic index of the coastal villages of Boetoeng Island varied between 50 and 100 per cent. There is no area in this island where malaria does not occur heavily.

(b) Dysentery. Bacillary dysentery. In Celebes bacillary dysentery is a common disease. The laboratory in Makassar has given ample information about the strains of dysentery organisms of southwestern Celebes. In the city of Makassar, Flexner strains of Shigella paradysenteriae were found more frequently than was the more serious Shiga strain (Shigella dysenteriae);outside Makassar the reverse was true. Of 862 organisms isolated in the regional laboratory of Makassar, 600 were Shigella dysenteriae, 231 were the Flexner strain of S. paradysenteriae, 25 were the Sonne strain of S. paradysenteriae, and 6 were the Schmitz strain of S. paradysenteriae. Even in the city of Makassar, Shigella dysenteriae was not rare, because it constituted about 20 per cent of the strains isolated. The frequency of occurrence of bacillary dysentery is indicated by the fact that in 1937 in southern

Celebes 4,040 cases were reported. Specific figures are available for the subdivisions listed in Table XI-18.

In 1938, in the southern part of Celebes, 4,520 cases were reported. In this part of Celebes, not only Shigella dysenteriae but also the Flexner strain of S. paradysenteriae has given rise to dangerous epidemics. In the Javanese colony of Wonoredjo, near Malekoe, an epidemic caused by a Flexner-Y strain of Shigella paradysenteriae resulted in many deaths in 1938. Members of prospecting expeditions in the Roembia-Poleang and Kendari areas of the southeastern peninsula are reported to have suffered severely from dysentery. Epidemics of bacillary dysentery have broken out in Celebes since the Japanese occupation. On Boetoeng Island the inhabitants never drink river water during the dry season because they know that such a practice might lead to dysentery.

Amebic dysentery. Amebic dysentery is common throughout Celebes.

(c) Typhus fever. It is virtually certain that two kinds of typhus fever--scrub or mite-borne typhus, and murine or so-called shop typhus--occur in that part of Celebes included in this survey. In 1934 the laboratory at Makassar reported one instance of scrub (mite-borne) typhus in a European. This was the first case reported from Celebes.

In 1939 it was reported that the disease occurred regularly in Minahasa, where it was even more frequent than flea-borne typhus (Minahasa is not included in that part of Celebes treated in this survey, but is of course contiguous to it). Most of the patients had no "scrub history" and primary lesions were found only rarely. Although systematic investigations in this field are not available, it seems probable that this disease is a frequent cause of fever in Celebes. The local vector has not been determined. Trombicula pseudo-akamushi has been reported from Celebes, but T. deliensis, the probable vector in New Guinea, has not been described.

In 1939 flea-borne murine typhus, the so-called shop typhus, was recognized as occurring regularly in Minahasa, north of the area comprised in this survey. The disease must also occur in the southern part of Celebes, because the laboratory at Makassar has occasionally recorded a few cases.

(d) Filariasis. Filariasis has been reported from nearly every part of Celebes. Only a few areas were known to be virtually free. No cases have been reported in the city of Makassar itself. Districts in which the filaria index is high are the southern part of the plains of Paloe, Donggala, the Todjo coast near Poso, the hills near Madjene, Simpang, Malili, Kolonadale, Kawata, Kendari, and the Roembia-Poleang area. In those regions the infection index varies between 15 and 50

per cent, and elephantiasis often has been seen. Most of the cases in Celebes are due to Wuchereria malayi. Wuchereria bancrofti is relatively rare, but is found together with W. malayi in the southern part of the area around Mamoedjoe and near Kolonadale. It is the sole form found in Boetoeng, Moena, and Kabaena, which are the islands off the tip of the southeastern peninsula. Filariasis is especially common in marshy regions near stagnant water, and becomes rarer as altitude increases. In Celebes infection with W. malayi is transmitted by Anopheles barbirostris barbirostris and by species of Mansonia, especially M. annulipes. Careful investigation has shown that in Celebes A. barbirostris barbirostris is the most active vector. In Mamoedjoe 3.7 per cent of A. barbirostris barbirostris have been found to be naturally infected. Another survey showed that in this area 8.9 per cent of A. barbirostris barbirostris harbored filariae, whereas Mansonia annulipes was found to be infected to the extent of 2.7 per cent. Experimental infection has shown that the filariae developed much more constantly and much more rapidly in A. barbirostris barbirostris than in species of Mansonia.

Filariasis likewise is common throughout the islands adjacent to Celebes. Conditions here have been studied carefully, because of the fact that in the island of Celebes itself filariasis almost always is

caused by Wuchereria malayi, whereas on the islands to the south of Celebes the causative agent is W. bancrofti. In Kamaroe on northeastern Boetoeng, seven patients with lymph scrotum were studied, four of whom were infected with W. bancrofti. In Ereke in Boetoeng, six out of eight patients with lymph scrotum had W. bancrofti. In Baebaoe, however, 39 inhabitants were examined, but no microfilariae were found. In one of the villages near Raha in Moena Island, 71 per cent of the people were found to be suffering from filariasis, and in Kabaena Island 28 of 96 people examined showed the presence of W. bancrofti. During a survey of this island 30 patients with lymph scrotum were encountered. In Wowoni, an island off Kendari, 45 per cent of the inhabitants were suffering from filariasis.

In Kabaena Island Anopheles aconitus, A. leucosphyrus hackeri, Culex quinquefasciatus and C. alis (vishnui) have been found to be naturally infected with filaria. As in the rest of the Netherlands East Indies, Culex quinquefasciatus apparently is not an effective vector; of 201 specimens caught, only one was found to be infected.

(e) Venereal diseases. Specific information about venereal diseases in Celebes is scanty. Gonorrhea is frequent among natives throughout the island. Syphilis among natives is said to be limited mainly to the harbor cities.

(f) Diseases of the skin. As in the rest of the Netherlands East Indies, scabies, fungus diseases, tropical ulcers and pyodermatitis are of frequent occurrence in Celebes. It is known that the incidence of such diseases has increased since the Japanese occupation. Fungus infections commonly are acute and resistant to treatment. Minor lesions of the skin are likely to become infected and to result in prolonged subacute or chronic ulcers. Travelers to the islands adjacent to Celebes comment on the frequency of occurrence of skin diseases in those areas.

(2) Islands other than Celebes.

(a) Malaria. Malaria is endemic throughout the Molukken Islands and islands of the eastern Banda Sea, especially in the coastal areas. Pernicious malaria and malarial cachexia were, however, rare, and black-water fever was said never to have occurred until recent years, when a few cases were described from Ceram. There are only a few islands where malaria is infrequent, as for instance, Saparoea and Nossalaoet of the Amboina Archipelago and the islands of the Banda Archipelago. Malaria is said to be absent from the volcanic isles in the southern part of the latter group. Although specific data as to the distribution of malaria according to strains of Plasmodium are lacking from this area, one may infer from what is known about malaria elsewhere in the Netherlands

East Indies that a high proportion of the infections are due to the estivo-autumnal type. Infection with P. malariae probably is rare. Severe outbreaks of malaria often follow the clearing of the forest, unless measures are taken to control breeding of Anopheles punctulatus punctulatus and A. punctulatus moluccensis, both of which breed in sunlit pools and puddles.

Malaria is known to be prevalent in the Soela Islands, as is indicated in Table XI-19.

In the Amboina Archipelago the incidence of malaria is variable. Amboina has had very little malaria in recent years. In most of the villages malaria is only moderately common; a spleen index of not more than 3 per cent is frequently found. Only the villages of Lima, Koesoe-Koesoesesah, Hila, Islam and Tawiri are highly malaricus. Here the spleen index varies between 41 and 75 per cent. Malaria was formerly severe at Paso, a village situated on the narrow strip of low land connecting Leitimor with Hitoe. The soil is marshy and is covered with sago forests where A. punctulatus moluccensis abounds. Paso, with 618 inhabitants, had a splenic index of 82 per cent in 1926 compared with Alang on the south coast of Hitoe, where the splenic index was only 6 per cent. As a result of careful sanitation, Paso was practically malaria-free in 1938.

Repeated inspection was necessary, however. An acute outbreak of malaria was reported in 1938 from Laha. In Amboina there is no genuine seasonal variation in malaria, although the number of cases increases slightly at the beginning and end of the rainy season. In Haroekoe Island malaria is widespread, but in Saparoea it is very infrequent, and the splenic index of the school children varies between 2 and 3 per cent. In Noesalaoet the splenic index of the school children is relatively low (2½ to 6 per cent). Every year, however, a certain amount of malaria is introduced into these islands when the inhabitants cross to malaricus south Ceram to obtain their sago.

The Batjan Islands are highly malarious.

In Ceram the capital city, Piroe, is highly malarious owing to an adjoining area of sago marshes, 10 square miles in area. In Passinaro and Wetoli, situated in the subdivision of Piroe, the spleen indices have been found recently to be 90 and 98 per cent, respectively; in Honitetoe, east of Piroe and inland, the spleen index was 43 per cent. In the subdivision of Riring, 30 miles northeast of Piroe, malaria is severe in the coastal areas but less severe in the mountains. Although the average figures for the spleen index in this region have varied between 20 and 30 per cent, in some hamlets the rate is as high as 74 per cent.

In Wahai on the northern coast the index was only 17 per cent in a recent survey. In Amahai on the southern coast, explosive outbreaks of malaria were reported in 1938. Boela in northeastern Ceram, where the large oil wells are situated, is very malarious. Somewhat old but probably still typical are the data in Table XI-20. In recent years many villages in eastern Ceram have shown a splenic index of 100. Here the children look haggard and anemic, with thin arms and legs and swollen abdomens caused by splenomegaly. Blackwater fever is reported to occur in Amahai on the southern coast.

On the island of Boeroe malaria is very common, especially in the marshy areas. The Alfura always live near a river, if possible on the edge of a marshy patch. In the dry season of 1939, in most of the villages in the marshy areas of the Wae Apo basin, a spleen index of 25 per cent was found. The index was lower in the drier sandy areas, but rose during the rainy season. Leksoela in southwestern Boeroe and Waploe on the northeastern coast were very malarious (spleen index, 45 per cent; parasite index, 57.5 per cent). In both villages large marshy areas formed by silting of the river mouths are a factor in the high malaria rate. Tifoe in Boeroe, just west of Leksoela, is much more healthful. In 1938, cases of blackwater fever were reported from Leksoela. The possible vectors of malaria found in Boeroe are Anopheles punctulatus punctulatus, A.

punctulatus moluccensis, A. barbumbrosus, A. subpictus subpictus, A. umbrosus, A. kochi and A. vagus vagus. Although no definite evidence is available, it can be assumed that A. punctulatus moluccensis is the most active vector.

By the way of contrast with the Molukken Islands, the islands of the Banda Archipelago were almost free from malaria at the time of the Japanese invasion. Malaria occurred very infrequently in the Banda Islands proper, and was nonexistent in the three southern volcanic islands.

In the Kai Islands, southeast of the Banda Islands, malaria is said to be widespread, although no data are available regarding anophelines. From comparison with other nearby islands, one may assume that Anopheles punctulatus moluccensis is the chief vector there. In the Aroe Islands, southeast of the Kai Islands, malaria actually occurs less often than in most of the Molukken Islands. In most villages the spleen index is less than 10 per cent; only exceptionally has an index of 20 per cent been found. In Dobo, the capital, the spleen index in 1938 was 12 per cent.

In the Tanimbar Islands, southwest of the Aroes, malaria occurs frequently. In 1923 the splenic index of children in these islands varied between 54 and 87 per cent; that of the adults, between 31 and 65 per cent.

In 1938 the district of Larat was found to be highly malarious. Data as to the probable vectors are not available.

Specific recent information is lacking concerning malaria in any of the island groups considered above, but early in 1945 it was reported that on one island--Selaroe in the Tanimbar Islands--malaria was prevalent, and that the treatment administered by the Japanese consisted of 3 sugar-coated quinine pills given daily to each patient until the fever abated. At that time the patient was returned to work. In another report, received early in 1945, but concerning liberated areas contiguous to the general areas included in this survey, it is said that malarious patients had never received any treatment from the Japanese, but had been abandoned.

(b) Venereal diseases. In these islands as a whole, syphilis rarely occurred among the natives. It was found mainly among Javanese immigrants and military personnel. Gonorrhea occurred more frequently among the natives. Granuloma inguinale, frequent in southern Dutch New Guinea, was not known to occur in the Molukken Islands. In the islands of the Amboina Archipelago syphilis has been found among the immigrant Javanese and the military personnel, but not among the natives.

(c) Dysentery.

1. Bacillary dysentery. Although the literature states that bacillary dysentery is rare in the Molukken Islands, this is

erroneous. The importance of bacillary dysentery in this area recently has become apparent. Specific information is still sketchy, but several outbreaks have been reported in recent years, even from remote parts of the Molukken Islands. As far as is known, dysentery is most frequent in the Tanimbar Islands and the Batjan Archipelago. In view of the high case fatality rate, the greater part of these cases are probably due to Shigella dysenteriae. Since the occupation by the Japanese, epidemics of dysentery have been raging through the internment camps in Amboina. It was said in 1945 that bacillary dysentery, in association with malaria, was causing most of the deaths in this region.

In the Batjan Islands it is thought that bacillary dysentery is introduced from time to time from Halmahera. One hundred patients who had bacillary dysentery were reported from these islands in 1937. Mass immunization had been carried out prior to the Japanese invasion, but doubtless has not been maintained.

The disease has occurred regularly on Amboina Island. In 1942, after the Japanese occupation, a serious epidemic of bacillary dysentery broke out in the internment camp that had been built on this island.

In Ceram, 20 years ago, it was stated that bacillary dysentery was rare; today this disease is recognized as being common.

The Tanimbar Islands are notorious for the prevalence of bacillary dysentery. In 1937 an outbreak of 500 cases with 40 deaths was reported.

At that time almost all the people were immunized. In 1938 only a few cases of dysentery were reported.

2. Amebic dysentery. In general, amebic dysentery probably is found in all the Molukken Islands and islands of the eastern Banda Sea. Since this disease is common in Halmahera, it doubtless has spread to the Batjan Islands. It occurs regularly in Amboina Island, and is known to be prevalent in Ceram. An outbreak of amebic dysentery has been reported from the Kai Islands.

(d) Filariasis. Elephantiasis is seen in many of the Molukken Islands and islands of the eastern Banda Sea. Special surveys have shown that the widespread filariasis in Ceram is caused by Wuchereria malayi, whereas in the rest of the Molukken Islands and even in nearby Boeroe only W. bancrofti has been found. The latter parasite also prevails in the Southwestern Islands, which are included in this survey.

Filariasis probably occurs in the Batjan Islands, even in the absence of specific reports, because it is known to be present on nearby Halmahera. It is likely to be encountered in the Soela Islands, although data there are very scarce. Elephantiasis is seen in all the islands of the Amboina group, where filariasis is caused by Wuchereria bancrofti. In Ceram filariasis is common in some areas and rare in

others (FIGURE XI-1). Of 1394 persons examined in north Ceram about 1933, 6 per cent were found to have elephantiasis and 12 per cent to have microfilariae in the peripheral blood. Figure XI-1 gives detailed data as to the prevalence of filariasis along the north central coast. Although comparable specific data are not available for the south coast, this area must be considered as equally involved. With a rare exception (possibly imported), Wuchereria malayi is the only type of filaria found in Ceram, whereas in nearby Boeroe and in the Amboina Archipelago only W. bancrofti occurs. On Boeroe Island filariasis is widespread; it has been carefully studied there on the plains of the Wae Apo (FIGURE XI-2). Of 832 people examined, 425 showed the presence of Wuchereria bancrofti, and 40 had elephantiasis. Elephantiasis has been reported from Saumlakki and Larat in the Tanimbar Islands, so that it can be assumed that filariasis is present. Studies of filaria have not been carried out in the Tanimbar Islands.

(e) Diseases of the skin. In the island as a whole, the disease of the skin occurring most often is tinea imbricata. Other skin diseases caused by infection with fungi are common, and scabies, impetigo and tropical phagedenic ulcers are widely distributed. Favus, however, is extremely rare.

In separate island groups, 5 per cent of the people of the Soela Islands have tinea imbricata. This disease, in association with tinea circinata, tinea albigena and tropical phagedenic ulcer, is very common in the Amboina Archipelago. About 5 per cent of the people exhibit extensive lesions of tinea imbricata. This disease is especially frequent in villages in which sulfur springs occur. About 15 per cent of the people have pityriasis versicolor. In Ceram possibly 30 percent of the people have tinea imbricata. One of the main centers of the disease is Atiahoe. Scabies, tropical ulcer and impetigo are almost as common there as tinea imbricata. In Boeroe, likewise, 30 per cent of the children have tinea imbricata; in some villages the percentage is as high as 50. This disease likewise is common in the Banda Islands and the Kai Islands.

B. Diseases of potential military importance.

(1) Endemic diseases.

(a) Celebes (north to the equator).

1. Common diarrheas. Diarrhea of unknown cause is one of the most frequently occurring conditions in Celebes. It may well be that some of these diarrheas are caused by species of Salmonella. On the other hand, the rarity with which the causative organisms of paratyphoid A, B, and C have been isolated in the laboratory of Makassar

should be kept in mind. A great many of these so-called common diarrheas may possibly have been cases of undiagnosed bacillary dysentery.

2. Respiratory infections. Epidemics of a disease resembling influenza have been reported every year from Celebes, although the exact etiology has not been determined. Other infections of the respiractory tract are not uncommon. The night temperature in the mountains may be low, and considerable differences between day and night temperature may favor the development of acute respiratory infections. In this part of the tropics pneumonia occurs frequently among the natives; the fatality rate is high. Measles broke out in epidemic form in Boetoeng in 1921; the case fatality rate was 10 to 30 per cent.

3. Dengue fever. Dengue occurs regularly, especially among new arrivals, but serious epidemics have not been reported for several years. Since both Aedes aegypti and A. albopictus abound in this area, occasional epidemics must be expected.

4. Cholera. This disease apparently is intermittently endemic in Celebes. It was reported early in 1945 that an epidemic had broken out, but complete details could not be obtained. It is possible that this epidemic involved the so-called El Tor cholera-like disease reported from the southwestern part of Celebes before the Japanese occupation.

The Netherlands East Indies were free from cholera from 1921 until 1937, except for nine cases which occurred at Batavia in 1927, all imported from Singapore. Between September 1937 and 1940, however, a small "cholera" outbreak developed in some native hamlets situated along the coast of southwestern Celebes and somewhat inland in the government districts of Pangkadjene, Gowa, Barroe and Maros. Cases also occurred in Salemo, Sanana and Samatellocelaoe, small islands of the Spermonde Archipelago, off the coast about 40 miles north of Makassar. Two cases occurred in Makassar itself.

The clinical picture was typical of cholera. The case fatality rate was 65 per cent, as is usually true in the presence of this disease. Wells and water jars used by "cholera" patients in southern Celebes were examined and found to be contaminated, whereas wells belonging to neighboring houses were not contaminated. Of 217 contacts of 40 "cholera" cases, 29 were found to excrete "cholera" bacilli. A few of these infected contacts later showed characteristics signs of cholera but none of them died. Of 183 probable contacts examined in 1937-1938, not one was infected, but in 1940 some healthy noncontacts were found to be carriers. In one village where there had not been a single suspected case, 1.3 per cent of the people were found to be carriers. Of 17 carriers, 11 were under the age of 16 years.

Epidemiologically and bacteriologically, this "cholera" epidemic in Celebes between 1937 and 1940 showed a few remarkable characteristics. There was hardly any tendency to epidemic spread. In each of 14 villages, only 1 case occurred; in each 4 villages, 2 cases; in only 1 village were 5 cases observed. With a few exceptions, there was never more than 1 case per family. These epidemiologic data indicate differences between this epidemic and usual cholera epidemics. In the opinion of most Dutch bacteriologists, these Celebes vibrios were identical with El Tor vibrios. This vibrio, which was first recognized in 1905, had been considered up until 1937 as nonpathogenic and, as far as known, had never been isolated in cases of typical cholera.

In view of extensive studies of this organism in 1937-1940, it was concluded that there was hardly any reason to distinguish the disease in southern Celebes as "enteritis choleriformis Tor" as had been proposed, but the conclusion was that in southern Celebes cholera actually occurs, probably endemically. Hence, the epidemic reported in 1945 may have had such a basis.

The two cases discovered in the harbor town of Makassar in 1937-1940 were reported as cholera and have been mentioned as such in the Bulletin de l'Office International d'Hygiène Publique. The harbor was,

however, not officially declared infected. The question as to why weakly hemolytic cholera strains have been recovered from cholera patients only in southern Celebes and not in other areas may well be connected with the widespread interest which for 25 years has existed in the Netherlands in the problem of the El Tor vibrios.

It cannot be stated definitely that the outbreak of cholera reported from Celebes in 1945 actually was the so-called El Tor cholera described above, but the possibility should not be overlooked.

(b) Islands other than Celebes.

1. Influenza. Minor outbreaks of this disease occur from time to time. The epidemic of 1918 took many lives, but since that year no severe epidemics have been reported.

2. Mite-borne typhus fever. It should be suspected that this disease is endemic in the Molukken Islands and islands of the eastern Banda Sea. It has not been described from this area, yet it is known to exist in such contiguous regions as Celebes and New Guinea.

(2) Diseases which may be introduced.

(a) Celebes (north to the equator).

1. Plague. It is known that plague broke out in Java in 1945. In Java this disease has been endemic since 1911, when the

disease apparently began to spread from the eastern part of the island. The disease began to extend westward in 1935, but has shown only a slight tendency to spread to the other islands of the archipelago. In 1922, cases occurred in Tandjoengbalei, an island of the Rioew Archipelago, in Palembang on Sumatra and in Makassar on Celebes. In Makassar 115 cases occurred between 1922 and 1930, but none have been reported since 1930. The peak of this small epidemic was in 1927, when 40 cases were recorded. No cases have been reported from Celebes outside Makassar. Whereas the reservoir of the plague bacillus in Java consisted of the Malayan house rat (Rattus diardii), in Makassar R. norvegicus and R. concolor were infected just as frequently as was R. diardii. Hence, it probably would be comparatively easy for this dise to be re-introduced.

(b) Islands other than Celebes.

1. Plague. Plague has not been reported from the Molukken Islands and islands of the eastern Banda Sea. Yet, as said above, the disease broke out in Celebes between 1922 and 1930. It could be introduced with little difficulty.

2. Dengue fever. Dengue fever has been reported occasionally among Occidentals in this area, but it is not known that the

disease actually is present. A widespread acute epidemic of dengue fever has not been reported in years, but there is constant danger of the occurrence of an outbreak because of the great numbers of Aedes aegypti.

3. Cholera. Cholera has not been reported from this general area for many years. The possibility should not be overlooked that the importation of cholera patients from other areas, plus the report of cholera in Celebes in 1945, might result in an outbreak of the disease. Sanitary conditions are such that widespread dissemination of the disease probably would follow its importation.

C. Diseases of minor military importance.

(1) Celebes (north to the equator)

(a) Typhoid fever and paratyphoid fever. Epidemic typhoid fever broke out in some of the larger cities of Celebes in 1945. Prior to that year, the disease was always fairly common in Celebes. In 1935 there were 153 cases of typhoid fever reported in Manado; in 1936 there were 148; in the next year, 79. In 1936 there were 26 cases in the city of Makassar and 14 cases around Makassar. In 1937 there were 26 cases reported in Makassar. Paratyphoid fevers were said to occur less frequently than typhoid. In contrast to the rest of the Netherlands East Indies,

paratyphoid fever A apparently was extremely rare in Celebes. Paratyphoid fevers B and C were reported, but only occasionally. Whereas the regional laboratory in Makassar reported hundreds of cases of bacillary dysentery each year, paratyphoid bacilli were found only very rarely.

(b) Conjunctivitis. During the season of the eastern monsoon, which brings dry weather between June and September, the atmosphere often is dusty. The dust apparently acts as an irritant which produces conjunctivitis during the indicated season.

(c) Schistosomiasis. This disease is of minor military importance, so far as Celebes is concerned, because it occurs in only one area, around isolated Lake Lindoe in the mountains of the Toradja region (2,700 feet). The parasite here is Schistosoma japonicum. About 50 per cent of the population living on the shores of this lake have been found to carry the ova of S. japonicum. Intestinal signs have not been observed, but many people have remarkably large spleens, which are larger than can be explained by chronic malaria alone. Autopsies have shown splenic and hepatic lesions caused by schistosome infection. Human beings, dogs and deer are infected. No snails of the genus Oncomelania have been found in Lake Lindoe, nor has any other snail

been discovered shedding furcocercous cercariae. Such cercariae are, however, found in snails of the genus Lymnaea in Lake Poso (1,500 feet) in central Celebes. From no other area in the Netherlands East Indies have infections with schistosomes been reported.

(d) Weil's disease. Weil's disease was first reported in Celebes in 1933, when four cases were recognized. In 1934 there was one case; in 1938 another was reported. All cases observed in Celebes were due to Leptospira bataviae. In 1938 it was found that 18 per cent of 77 Rattus norvegicus in Celebes were infected with leptospira, 10 per cent of 211 R. concolor, 1.5 per cent of 212 R.diardii, and several dogs. In R. norvegicus, Leptospira bataviae was present; in Rattus concolor, the nonpathogenic L. javanica was found. This organism was also found in the few infected house rats. From a dog in Makasser a strain was cultivated which was serologically identical with the Australian type "ballico." Neither in human beings nor in animals has L. icterohaemorrhagiae been discovered.

(e) Infectious jaundice. This disease was reported from Moena Island in 1935.

(f) Cerebrospinal meningitis. Although in recent years no

serious epidemics have been reported, the disease has occurred regularly in large areas of Celebes. Every year the laboratory in Makassar reported a few cases, three in 1937 and four in 1938.

(2) Islands other than Celebes.

(a) Typhoid fever. It is said that this disease is rare, but it should be emphasized that in these islands neither bacteriologic surveys nor necropsy statistics are available, so that reliance cannot be placed on such a statement. The disease occurs regularly in the city of Amboina on Amboina Island, but is said to be rare in the rest of the island. During 1938 there were 13 cases reported from the city of Amboina and 2 from Saparoea. It is very possible that typhoid fever occurs more commonly than this, for even in Amboina, the center of the Molukken Islands, no facilities for the laboratory diagnosis of typhoid fever exist, and necropsies are rarely performed.

(b) Trachoma-like conjunctivitis. A condition which may be trachoma or some trachoma-like disease is very common in this particular region. There is great confusion as to the nature of the condition. For a long time there was discussion as to whether the disease of the eyes so common in these areas could be trachoma. Some authors were of the opinion that the disease is mainly conjunctivitis granulosa, but in recent years this suggestion has been abandoned. A trachoma-like disease

occurs frequently among the children in the Soela Islands, and apparently is widespread among the school children of Amboina on Amboina Island. In this city it appears that the disease may be a form of conjunctivitis. About 20 to 40 per cent of the children are affected.

(c) Bronchospirochetosis. This disease has been reported from the city of Amboina on Amboina Island, but its existence has not been confirmed. Available evidence indicates that hemotysis on Amboina, in most cases, is of tuberculous origin.

C. Diseases common among the civil population.

(1) Celebes. (north to the equator).

(a) Yaws. This disease is common in natives throughout Celebes. The districts of Loewoek, Bira and Singkang have been especially mentioned for their high incidence of frambesia, but in the rest of Celebes the incidence is probably just as high. In Singkang in 1 year, 16,600 injections of neoarsphenamine were given for the treatment of yaws. The disease is notoriously prevalent in the Toekangbesi Archipelago as well, and there is no reason to suppose that the incidence of the disease is less on any of the other islands near Celebes. In a report received in 1945 it was said that the incidence of yaws since the Japanese invasion has increased tremendously, especially among children.

(b) Trachoma. Trachoma prevails throughout Celebes. It is frequent along the rivers and relatively rare in the isolated mountain

villages. In 1935 in the Watampone area 4.7 per cent of 13,882 inhabitants were proved to suffer from trachoma. None of the villages was free from the disease. In Tempe the infection was found in 8.9 per cent, and in Lengkang in 8.4 per cent of the people examined. Even these figures are lower than the infection rate found in Java. In the rest of the villages of southern Celebes, 1 to 5.7 per cent of the inhabitants suffer from trachoma.

(c) Helminthiasis, excepting schistosomiasis. Ascaris lumbricoides and Ancylostoma duodenale are common intestinal parasites in Celebes. Infection rates vary, but in many areas more than 50 per cent of the people carry these parasites. On the basis of published reports the impression is obtained that Trichuris trichiura, Enterobius vermicularis and Strongyloides intestinalis occur less frequently.

Around Lake Lindoe in Celebes the Toradjas are heavily infected with Echinostoma lindoense (37 spines). The first intermediate host in Celebes is a snail, Anisus sarasinorum, which resembles species of Planorbis; the second intermediate host is the fresh-water mussel, Corbicula linduensis. The patients acquire the parasite by the consumption of insufficiently cooked or raw fresh-water mussels. There is also another snail which can act as the second intermediate host, Viviparus javanicus rudipellis. Since this snail is not eaten in this part of Celebes, its

practical importance in the transmission of the disease must be negligible. In the coastal area near Makassar and near Lakes Poso and Rano Dompelas snails infected with the metacercariae of a 37-spined echinostome have been found, but no human carriers of Echinostoma lindoense could be discovered. Sporadic infections with Euparyphium ilocanum are encountered in the coastal areas of Celebes and near Lake Poso.

(d) Tuberculosis. As in the rest of the Netherlands East Indies, tuberculosis is common in Celebes.

(e) Leprosy. In 1939 there were 4,518 known cases of leprosy in Celebes. In the subdivisions of Madjene and Manasa (population 184,000) there were 638 leprosy patients in 1929. During 1937, examination in the Makassar laboratory revealed 157 new cases of leprosy. It may be assumed that the total figure of 4,518 lepers is much smaller than the actual number of cases of leprosy present in Celebes. Leprosy is widespread in the islands around Celebes. In 1937 enough chaulmoogra oil to treat 50 lepers was sent to Bacebace on Boetoeng Island.

(2) Islands other than Celebes.

(a) Yaws. In the Molukken Islands and islands of the eastern Banda Sea, yaws is of such frequent occurrence that every native may be

assumed to have suffered from this disease in childhood. This holds true even for the small islands of the Banda group which are practically cut off from sea lanes. Before the war, about 80,000 neoarsphenamine injections were performed annually for patients in the Molukken Islands who had yaws. Since the greater part of this treatment was not systematically followed, the incidence of the disease did not diminish. Only in Riring on Ceram, where three neoarsphenamine injections were systematically given to every yaws patient at weekly intervals, did the incidence of the disease actually diminish.

In the eastern part of Ceram Island yaws or boba is general, and frequently leads to mutilating rhinopharyngitis. On Boeroe Island yaws is so widespread that the natives believe it is necessary for every person to have the disease. Yaws is less prevalent in the Aroe Islands than in most islands in that general vicinity, but is widespread in the Tanimbar Islands to the southwest of the former group.

(b) Trachoma. Trachoma as such seems to be prevalent throughout the area. For some time there was discussion as to whether the ophthalmic disease so common in these areas could be trachoma. Some said that the disease is mainly conjunctivitis granulosa, but in recent years this suggestion has been abandoned. In the Soela Islands trachoma is known to

be present, together with the trachoma-like disease previously mentioned. The disease occurs in Amboina on Amboina Island, as does the trachoma-like conjunctivitis in question. Trachoma is widespread in the Tanimbar Islands, southeast of Amboina. It is said to be rare on Boeroe Island.

(c) Helminthiasis. In general, infections with Ascaris lumbricoides and Ancylostoma duodenale are widespread throughout the Molukken Islands and islands of the eastern Banda Sea. Almost all the children in the Amboina Archipelago have ascariasis, and hookworm disease is prevalent, especially in Saparoea Island. On this island, it is said, 50 per cent of hospitalized patients often are admitted for treatment of ancylostomiasis. In Kiring on Ceram Island ancylostomiasis is said to be particularly common; the disease occurs all over this island.

(d) Tuberculosis. Tuberculosis is common throughout the Amboina Archipelago. In Saparoea the disease is especially widespread. Unfortunately, many Ambonese, educated as school teachers, are instrumental in the dissemination of tuberculosis throughout the Molukken Islands. In 1932 a general survey showed that 64 per cent of Ambonese children of 13 years had a positive reaction to the von Pirquet test. The largest number of positive reactions was found among the inhabitants of the city of Amboina and the coastal villages. Conditions among the mountain people

were somewhat better. A survey of the island of Amboina, which was made in 1932 without the help of X-ray equipment, showed that 1.9 per cent of the inhabitants had active tuberculosis. The tuberculosis mortality rate for the whole island was 227 per 100,000; but in the mountain villages the rate was only 65 per 100,000. Plans for the construction of a public sanatorium were completed in 1938. Tuberculosis is widespread in the island of Ceram, but exact data as to incidence are not available. The disease is reported to be present in the Tanimbar Islands, but was said, before the Japanese invasion, to have been uncommon. Information received in 1945 indicates that wherever tuberculosis existed before the invasion, the situation now is much worse.

(e) Leprosy. Leprosy, generally, is widespread in the Molukken Islands and islands of the eastern Banda Sea. The disease is present in the Batjan Islands, where in 1938 Laboeha requested the construction of a leprosarium. In 1923 it was possible to examine 2,500 of the 10,000 inhabitants of Sanana in the Soela Islands. Among this group, 8 lepers were found; the total number of lepers on this island was estimated at 40.

Leprosy is unusually common in the Amboina Archipelago. In 1922 there were 265 known lepers on Amboina Island; in 1931 this figure was

825, and in 1938 it was 350. The center of the disease was in the city of Amboina, where 0.56% of the people were estimated to be infected in 1931. The more remote the villages, the lower the rate. The villages of the Leitimor peninsula are the most heavily infected. In two of these villages, Amahoesoe and Lata, 1.1 and 1.16 % of the people, respectively, were infected in 1931. By contrast, most of [illegible]illages on the Hitoe peninsula of Amboina were free from leprosy. In Saparoea 51 cases were found in 1901. In 1929 this number had increased to 88; in 1937, to 115. The number of lepers in Noesalaoet was 12 in 1901 and 6 in 1923; in Haroekoe there were 25 lepers in 1901 and 40 in 1923. The people take no precaution against leprosy; lepers live together with healthy members of their families. Often healthy families with children adopt a leprous child. There is a large leprosarium in Amboina with 215 patients.

On Ceram Island, on the other hand, leprosy is relatively rare. In an eastern area, with a population of about 10,000, only 2 lepers could be discovered in 1931; but in the small island of Geser, southeast of Ceram, 6 lepers were found among a total population of 556. In eastern Ceram 17 leprosy cases were known in 1938. In western Ceram leprous patients were seen only occasionally

The disease seems to be rare, likewise, on Boeroe Island, southwest of Ceram. In the surveys of 1923, investigators visited 14 villages inhabited by 3,000 natives, but the disease was not found. In the Kai Islands leprosy is more common than it is in many islands of the Banda Sea: In 1936, of 15,697 persons examined in the Kai group, 105 were found to be lepers. The disease was much more frequent in Great Kai, where 0.93% of the people were infected, than in Little Kai, where the infection rate was 0.3%. The disease prevailed in Little Kai along the southeastern and northeastern coast. In Great Kai all the coastal districts were affected. There the central mountain villages also harbored many lepers. In the mountain villages of Waoer and Ngefoeit, 8.2 and 17.4 % of the people, respectively, were lepers. In 1938 there were 140 known lepers in the Kai Islands. A leprosarium is situated on the Bay of Elat.

Leprosy apparently is rare in the Aroe Islands, where, in 1938, only 7 cases were known. A new leprosarium was opened in Dobo in 1937, but in 1938 it had only 4 patients. The disease is common in the Tanimbar Islands, southwest of the Aroe group; in 1938 about 50 lepers were known. There is a leprosarium in Saumlakki, to which 40 patients were admitted. The natives themselves make no provision for treatment of lepers, but exclude them from their villages.

E. Miscellaneous diseases.

(1) Celebes (north to the equator).

(a) Smallpox. Widespread vaccinations had almost stamped out smallpox in the Netherlands East Indies. In Celebes a minor epidemic of smallpox occurred in 1931 in Kawangikatan in Minahasa. In 1936 there were 3 cases in Paloe. Between 1936 and 1940 no cases were reported. Information contained in a report received in 1945 is ambiguous: there was intimation that in some areas the practice of vaccination for smallpox has been continued by the Japanese but that in other areas it had been abandoned.

(b) Diphtheria. Diphtheria occurs regularly in Celebes. Although no serious epidemics have been described recently, the laboratory in Makassar reported a certain number of positive cultures every year. There were 25 cases in 1936 and 33 cases in 1938. In the same year 18 carriers were discovered.

(c) Measles. Measles once occurred in dangerous epidemics on and near Boetoeng Island off the southeastern part of Celebes. In 1921 an epidemic of this disease, with a case fatality rate of 10 to 30% was reported from this island.

(d) Nutritional diseases. Up to the Japanese invasion, nutritional diseases had not been frequently recorded in Celebes.

Occasionally, crops or animals have failed, and scarcity of food has resulted. This is probably less frequent in Celebes than in any other parts of the Netherlands East Indian Archipelago. In 1936 scarcity of food occurred in Loewoak, where cases of beriberi were also observed. There was a scarcity of food in Rampi in Masamba in 1937. In Kendari in southeastern Celebes, the people live mainly on sago and fish. Here malnutrition and beriberi are not rare.

Goiter is endemic in extensive areas of the mountainous interior of Celebes.

In the islands close to Celebes the general nutritional condition of the people has hardly been satisfactory in the past, and certainly would not be expected to be satisfactory now. The people eat sago or corn, and sometimes taro. Beriberi outbreaks were not rare and in recent years, especially in Kendari, outbreaks of beriberi have been reported. It was said in 1945 that after they occupied this general area, the Japanese in many areas seized foodstuffs and cattle, and that in such areas the native people are now much underfed. Beriberi has broken out and other deficiencies of the vitamin B complex have developed. Some of the ulcers reported to have occurred recently in this area doubtless have a basis in malnutrition.

(2) Islands other than Celebes.

(a) Smallpox. Until 30 years ago, smallpox was extremely

common in the Molukken Islands, but had been virtually stamped out by vaccination, despite the fact that in certain areas of Boeroe and Ceram the native population has been opposed to vaccination. It was generally assumed, however, that a satisfactory part of the Molukken people have been vaccinated. Only in the aforementioned islands and in the Kai Islands was there a substantial number of unvaccinated people in 1938. The situation since the Japanese invasion is not clear. In liberated areas contiguous to the area under discussion, a report received in 1945 indicated that vaccination had not been provided by the Japanese, but that, at the same time, smallpox had not broken out.

(b) Diphtheria.

This disease apparently has been important only on Ceram Island, on the basis of reports. In that place it was said that formerly the disease was rare, but that in recent years the infection has been frequently recognized.

(c) Measles. Although measles is said to be almost unknown on Ceram Island, this statement is open to question. If it is correct, a disastrous outbreak may be expected among the native people if the disease is once introduced. The disease has not been included among those reported in 1945 from this area or contiguous liberated areas.

(d) Nutritional diseases. Even before the Japanese invasion, the general opinion was that almost all the sago-consuming native peoples of the Molukken Islands were on the verge of developing beriberi. The complete clinical picture was frequently observed in women following childbirth and in infants. An acute infection or incarceration in prison was often sufficient to cause the disease to appear in acute form. About 90% of the natives who wanted to enlist in the army had to be rejected, mainly for "beriberi heart." It was almost impossible to obtain the cooperation of the native peoples in the campaign against the disease. Mungo beans distributed free of cost were thrown away, and the natives were unwilling to start the cultivation of vegetable gardens so long as sago was growing all around and could be obtained with a minimum of exertion. In prisons and in hospitals, outbreaks of beriberi were prevented by requiring consumption of vegetables containing vitamin B.

Even before the Japanese invasion, xerophthalmia and hemeralopia were common. Beriberi was common, for instance, at Saparoea in the Amboina Archipelago. There the incidence varied from year to year. In 1936 the disease was prevalent among the women and children of that island, but was less common in 1938.

On Ceram Island the nutritional condition of the Alfurs of the mountain areas was much better than that of the natives of the coastal

regions, where sago constitutes the chief article of diet. Gardens are rare, especially on the southern coast, where bananas are scarce and no rice is eaten. This explains the frequency of occurrence of beriberi in the coastal districts of Ceram. For years it was thought that the prevailing form of the beriberi of these sago eaters consisted of polyneuritis, whereas the wet form of beriberi was said not to occur. In recent years, however, the frequency of occurrence of beriberi heart among sago eaters has been emphasized. In 1937 beriberi was especially common on Amahai on the southern coast.

On Boeroe Island, the nutritional condition of the Alfurs living in the interior mountainous areas was worse than that of those living in coastal areas. Beriberi occurs frequently. A severe outbreak was reported in 1937 from Waplace in northern Boeroe. In the mountains goiter is common, especially around Lake Rana. Boeroe is one of the few islands of the Molukken groups where goiter is known to occur.

In the Aroe Islands beriberi is found in almost every native village. In 1938 many cases were reported from the vicinity of Dobo, where 8% of the people had beriberi. An explosive outbreak of beriberi was reported from Kojdjabi.

The situation in the Molukken Islands and islands of the eastern

Banda Sea now is probably much worse. It was reported in 1945 that in contiguous liberated areas, the Japanese seized virtually all foodstuffs for their own use. Specific information was secured in 1945 from Selaroe Island in the Tanimbar Islands: there the Japanese seized all native prahoes, so that the customary deep-sea fishing of the natives had to be abandoned. Gardens maintained by the natives were looted periodically by the Japanese. Beriberi was prevalent. In contiguous liberated areas, to the northeast, natives released from concentration camps were found to be underfed; many had died of simple exhaustion. Those living had anemia and symptoms of deficiency of the vitamin B complex. All were in a serious condition, from the nutritional standpoint.

114. Recommendations.

The following measures of control are considered of importance for personnel operating in Celebes, Molukken Islands and islands of the eastern part of the Banda Sea, and are intended to supplement the general sanitary precautions ordinarily in force in all areas.

A. Water supply.

All water, regardless of its source, should be considered to be unsafe as found. In Celebes one or two municipal supplies may have been properly equipped to produce safe water, but even water from these

supplies should not be considered safe until a thorough sanitary engineering survey has shown that the supplies are properly located and constructed, and that proper operating practices are in effect, including adequate analytical control.

B. Sewage.

With virtually no exceptions, satisfactory disposal of sewage may be considered to be nonexistent. Hence, suitable plans for the disposal of wastes must be made wherever troops are stationed. Careful disposal of wastes is of essential importance, in view of the prevalence of enteric infections. Natives employed by the military forces must be provided with their own toilet facilities, and must be made to use them properly.

C. Control of flies.

Because of the prevalence of enteric diseases, control of flies will be imperative. Thorough screening of buildings, mess halls, kitchens and latrines will be necessary. The use of bed nets, insect repellents and sprays should help to protect personnel.

D. Sanitation and control of food and food handlers.

Because of the high incidence of enteric infections, especial care must be exercised in the storage and preparation of food in army camps.

All native produce should be considered contaminated and should be cooked before it is eaten, or treated with chemicals issued by the quartermaster for this specific purpose. Artificial ice, if used to chill drinks or food, must not be used in such a way as to contaminate the food or drinks, or their containers. Troops should be cautioned as to the risks of eating native foods in general, and particularly of eating in other than approved establishments. Thick-skinned fruits need not be cooked, but should be washed before they are peeled and eaten.

E. Control of mosquito-borne diseases.

The island of Celebes is highly malarious, and malaria is endemic throughout the Molukken Islands and the islands of the eastern Banda Sea, especially in the coastal areas. Filariasis is reported from almost every part of Celebes, and is widespread in the Molukken Islands and islands of the eastern part of the Banda Sea. There is danger of the occurrence of dengue fever because, even though reported cases may represent imported infection, the vectors of the disease are abundant. Thus, control of mosquitoes will be of paramount importance at all times in this area. Measures of control should include:

(1) Elimination of breeding of mosquitoes.

(2) If possible, location of camp sites on high ground, preferably one mile or two miles from important breeding places and native habitations, so they will be beyond the effective range of flight of mosquitoes.

(3) Screening of military buildings and use of mosquito sprays where needed. As soon as possible after the arrival of troops in a new area, all habitations for them should be treated with DDT residual spray. Entrance vestibules with a screened door at each end (mosquito lock) will prove invaluable in excluding mosquitoes from buildings.

(4) Liberal use of insect repellents.

(5) After sundown, the wearing of protective clothing, such as long-sleeved shirts, trousers and high shoes, in mosquito-infected areas. Head nets and mosquito nets should be worn, when feasible, by personnel especially exposed to mosquitoes.

(6) Use of bed nets issued as individual equipment before the arrival of troops, and thus available for immediate use.

(7) A supply of antimalarial drugs sufficient for 100% suppressive treatment, to be used at the discretion of the surgeon.

F. Control of mite-borne typhus fever.

It is virtually certain that scrub or mite-borne typhus fever occurs in Celebes, even though the local vector has not been determined. The disease is suspected to be present in the Molukken Islands and islands of the eastern part of the Banda Sea. Camp sites should be cleared by the burning of all grass and shrubs. If possible, only natives should be used for this work. Long trousers, leggings and high shoes have protective value. Suitably impregnated clothing is especially valuable. Suitable mite repellents should be used. Prophylactic inoculation is as yet of no value.

G. Control of flea-borne diseases (endemic flea-borne typhus fever and plague).

Flea-borne murine typhus fever, known in this area as "shop typhus", has been identified by the laboratory at Makassar in Celebes, and it occurs regularly in the Minahasa region of Celebes, not included in this chapter but immediately contiguous. Plague broke out in Java in 1945, and has occurred in Celebes.

Buildings should be of ratproof construction, so far as possible, and rat-control programs should be enforced in all camps. Most native buildings must be considered as harboring rats and fleas. Such buildings

are unsatisfactory for living quarters or offices unless they have been subjected to preliminary sanitation. Adequate stocks of plague vaccine should be available for use in the event of an outbreak of plague.

H. Control of schistosomiasis.

Schistosomiasis occurs in only one small inland area of Celebes (the Lake Lindoe region), and has been reported thus far from no other part of the Netherlands East Indies. In this particular area no bathing should be allowed in streams or lakes, and unnecessary wading in such waters should if possible be avoided. Copper sulfate added to the water also is effective in controlling snails. Water treated with sufficient chlorine to give a residual of one part per one million after thirty minutes' contact is safe for drinking, bathing and laundering purposes, even in areas of known infection. The avoidance of bathing in inland waters of doubtful safety also will help to prevent leptospirosis, which has been reported from Celebes.

I. Control of cholera.

Cholera apparently broke out in Celebes in epidemic form in 1945; prior to that, a cholera-like disease had been reported from Celebes. If the disease occurs among either military or civilian personnel, stimulating doses of vaccine should be administered to all troops. Strict attention to water and food sanitation, to the disposal

of excreta and to control of flies will be essential to reduce the risk of spread.

J. Control of hookworm.

Ancylostomiasis is common throughout Celebes, the Molukken Islands and islands of the eastern part of the Banda Sea. The location of camps on sites not recently used for human habitations, coupled with the sanitary disposal of excreta, and good personal hygiene, will do much to prevent infection. Troops' walking barefoot over the soil definitely should be avoided, especially in moist, shaded soil in which larvae of hookworm abound.

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TABLE XI-1

Public water supplies of
Celebes (north to the equator)

Place	Population	Source*			Treatment	Considered reliable by Dutch officials	Number of connections		Consumption (gallons per day)		
		Wells	Springs	Surface			Private and industrial connections	Public tap	Total	Per capita (total population)	Per capita (population served assumed 5 persons per connection)
Donggala	2,200	x	-	x	-	-	19	1	5,080	2.3	51
Paloe	33,259	x	-	-	-	-	137	-	22,700	.7	33
Poso	2,100	x	-	x	-	-	-	-	-	-	-
Loewoek	7,906	-	-	x	-	-	64	-	21,700	2.7	53
Banggai	-	x	x	-	-	-	-	-	-	-	-
Kendari	29,911	-	-	x	x	-	136	1	14,950	.5	22
Baoebaoe	1,500	-	x	-	-	-	163	16	76,000	5.1	93
Palopo	2,900	-	-	x	x	-	-	-	-	-	-
Parepare	3,600	x	x	-	-	-	213	-	22,500	6.3	21
Makassar	84,000	x	-	x	x	x	2,699	-	349,700	4.2	26
Watampone	-	x	x	-	-	x	-	-	-	-	-
Watansoppeng	-	-	-	-	-	x	-	-	-	-	-
Total	-	7	4	6	3	3	-	-	-	-	-

*Principal supply is underlined.

TABLE XI-2

Average annual rainfall (in inches)
on Amboina Island and Saparoea Island

Month	Amboina	Saparoea
January	5.4	4.4
February	4.8	4.4
March	5.2	5.0
April	11.0	7.2
May	20.7	20.0
June	25.2	26.4
July	24.0	24.3
August	17.0	16.7
September	9.6	10.0
October	6.4	7.5
November	4.8	4.0
December	5.6	5.6

TABLE XI-3

Average annual rainfall (in inches) on the northern and southern coasts of Ceram Island

Month	Wahai (northern coast)	Amahai (southern coast)
January	12.4	4.5
February	16.6	4.2
March	12.7	5.6
April	8.1	8.1
May	6.1	13.8
June	4.8	15.1
July	4.1	16.9
August	3.5	16.2
September	3.2	9
October	3.9	6.1
November	4.4	4.3
December	8.2	4.3
Total	88.2	108

TABLE AI-4

Average annual rainfall (in inches)
in the Banda Islands

Month	Rainfall
January	10.2
February	8
March	8.8
April	13.2
May	15.9
June	14.7
July	8.4
August	4.5
September	4.9
October	4.6
November	5.4
December	9.7
Total	108.3

TABLE XI-5

Average annual rainfall (in inches)
in the Kai Islands

Month	Rainfall
January	13.6
February	10.5
March	12.7
April	10
May	8.4
June	5.8
July	5.1
August	3.1
September	2.2
October	3.6
November	6.5
December	12.2
Total	93.6

TABLE XI-6

Average annual rainfall (in inches)
in Dobo in the Aroe Islands

Month	Rainfall
January	11.0
February	11.2
March	8.6
April	7.9
May	6.2
June	5.7
July	5.3
August	3.2
September	3.1
October	4.3
November	6.6
December	9.5
Total	82.1

TABLE XI-7

Average annual rainfall (in inches)
in Saumlakki, capital of the Tanimbar Islands

Month	Rainfall
January	11.7
February	9.7
March	8.3
April	5.4
May	9.8
June	4.0
July	2.7
August	0.4
September	0.2
October	1.5
November	3.1
December	8.2
Total	65.2

TABLE XI-8

Anopheline mosquitoes found in Celebes proper and in immediately contiguous islands

CELEBES PROPER[1]	
Species	Place
A. aconitus	widespread
A. barbirostris barbirostris	widespread
A. barbumbrosus	Poso, Madjene
A. hyrcanus nigerrimus	widespread
A. karwari	Toradja area, Madjene, Mandar
A. leucosphyrus leucosphyrus	
A. leucosphyrus hackeri	Mamoedjoe, Toradja area, Madjene, Tolitoli
A. maculatus maculatus	Toradja area, Watampone, Balangnipa
A. minimus minimus	Poso, Paloe
A. parangensis	Manado, Paloe, Makassar
A. subpictus subpictus	widespread
A. sundaicus	southwestern Celebes
A. tessellatus	Manado, Paleleh, Toradja area, Polewali
A. umbrosus	Poso, Madjene
A. vagus vagus	widespread

ISLANDS CONTIGUOUS TO CELEBES			
Species	Boetoeng[1]	Muna[1]	Kabaena[2]
A. aconitus	-	-	+
A. aitkenii aitkenii	+	-	-
A. barbirostris barbirostris	-	+	+
A. kochi	-	-	+
A. leucosphyrus leucosphyrus	+	-	-
A. leucosphyrus hackeri	-	-	+
A. maculatus maculatus	-	-	+
A. minimus minimus	+	+	+
A. subpictus subpictus	+	+	-
A. sundaicus	+	-	-
A. tessellatus	-	-	+
A. vagus vagus	-	+	+

Sources: 1. Swellengrebel, N. H., and Rodenwaldt, E.: Die Anophelinen von Niederlandisch Ostindien. Jena, Gustav Fischer, ed. 3, 1932.

2. Brug, S. L.: Filaria bancrofti-overbrengers op Kabaena. Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indie 27: 88-98, 1938.

TABLE XI-9

Anophelines found in the Molukken Islands and islands in eastern part of Banda Sea[1]

Species	Batjan Island	Amboina	Saparoea	Ceram	Boeroe	Soela	Banda	Kai	Aroe	Tanimbar
A. aitkenii aitkenii	-	+	-	-	+	-	-	-	-	-
A. albotaeniatus	-	-	-	-	-	+	-	-	-	-
A. barbumbrosus	-	+	+	+	+	+	-	-	-	-
A. hyrcanus nigerrimus	-	-	-	-	-	-	-	-	-	-
A. insulaeflorum	-	+	+	+	-	+	-	-	-	-
A. kochi	-	+	+	+	+	+	-	-	+(?)	-
A. longirostris	-	-	-	-	+	-	-	-	-	-
A. ludlowii	-	-	-	+	-	-	-	-	-	-
A. maculatus maculatus	-	-	-	-	-	-	-	-	+(?)	-
A. minimus minimus	-	-	-	-	-	-	-	-	-	-
A. parangensis	-	-	-	+[3]	-	-	-	-	-	-
A. punctulatus moluccensis	+	+	+	+	+	+	+	-(?)	+	-(?)
A. punctulatus punctulatus	+	+	+	+	+	+	+	-(?)	+	-(?)
A. subpictus subpictus	+	+	-	+	+	+	-	-	-	-
A. sundaicus	+	-	-	-	-	-	-	-	-	-
A. tessellatus	-	+	+	+	+	+	-	-	-	-
A. umbrosus	-	-	-	-	+	-	-	-	-	-
A. vagus vagus	-	+	-	+	+	+	-	-	-	-
A. gracilis	-	-	-	+	+	-	-	-	-	-
A. travestitus	-	-	-	+	+[2]	-	-	-	-	-

Sources: 1. Swellengrebel, N. H., and Rodenwaldt, E.: Die Anophelinen von Niederlandisch Ostindien. Jena, Gustav Fischer, ed. 3, 1932.
2. Soetrisno. Filariasis onder de bevolking van de Wae Apovlakte [Boeroe]. Geneesk. tijdschr. v. Nederl.-Indie 80: 2313 (Sept. 24); 2349 (Oct. 1) 1940.
3. Brug, S. L., and de Rook, H.: Filariasis in Nederl.-Indie. Geneesk. tijdschr. v. Nederl.-Indie 73: 264-279 (Feb.) 1933.

TABLE XI-10

Culicine mosquitoes reported from Celebes and immediately contiguous islands[1]

Aedes aegypti
A. albopictus
A. lineatopennis
A. poicilia
A. scutellaris
A. vexans
A. vigilax
Armigeres malayi
A. obturbans
Culex annulirostris
C. bitaeniorhynchus
C. fuscanus
C. fuscocephalus
C. gelidus
C. quinquefasciatus (fatigans)
C. sinensis
C. sitiens
C. tritaeniorhynchus siamensis
C. vishnui
C. whitmorei
Mansonia annulata
M. longipalpis

Source: Bonne-Wepster, J., and Brug, S. L.: Nederlandsch-Indische Culicinen. Geneesk tijdschr. v. Nederl.-Indie 77: 515-617 (Mar. 2) 1937.

TABLE XI-11

Culicine mosquitoes reported from the Molukken Islands and islands in eastern part of Banda Sea[1]

Species	Soela	Amboina	Saparoea	Ceram	Boeroe	Banda	Aroe	Tanimbar
Aedes aegypti	-	+	+	+	+	+	-	-
A. albolineatus	-	-	+	+	-	-	-	-
A. albopictus	-	+	+	+	-	-	-	-
A. albosoutellatus	-	-	-	+	-	-	-	-
A. annandalei	-	-	-	+	+	-	-	-
A. aureostriatus[2]	-	-	-	+	-	-	-	-
A. funereus ornatus	-	-	-	+	-	-	-	-
A. imprimens	-	+	-	+	-	-	-	-
A. lineatopennis	-	+	-	-	-	-	-	-
A. scutellaris	+	+	+	+	+	+	+	+
A. tonsus[2]	-	+	-	-	-	-	-	-
A. vexans	-	-	-	+	-	-	-	-
A. vigilax	-	-	-	-	-	-	+	+
Culex alis	-	-	-	+	-	-	-	-
C. annulirostris	-	-	-	+	-	-	-	+
C. bitaeniorhynchus	-	-	-	-	-	-	-	-
C. halifaxii	-	-	-	-	-	-	-	+
C. pullus[2]	-	-	-	+	-	-	-	-
C. quinquefasciatus (fatigans)	-	+	+	+	-	+	+	-
C. sitiens	-	-	-	+	+	-	-	+
C. squamosus[2]	-	-	-	+	-	-	+	-
C. tritaeniorhynchus siamensis	-	-	-	+	-	-	-	-
C. vishnui	-	-	-	-	-	-	-	-
Armigeres obturbans	-	-	-	+	-	-	-	-
A. confusus	-	-	+	+	-	-	-	-
A. malayi	-	-	+	+	-	-	-	-
A. spathulatus[3]	-	-	-	+	-	-	-	-
Mansonia longipalpis	-	-	-	-	-	-	-	-
M. uniformis	-	-	-	+	-	-	-	-

Sources: 1. Bonne-Wepster, J., and Brug, S. L.: Nederlandsch Indische Culicinen. Geneesk. tijdschr. v. Nederl.-Indië 77: 515-617 (Mar. 2) 1937.
2. Brug, S. L.: Notes on Dutch East Indian Mosquitoes. Bull. Entomol. Research 25: 501-519 (Dec.) 1934.
3. Brug, S. L.: Notes on Dutch East Indian Mosquitoes. Tijdschr. v. entomologie 82: 91-113, 1939.

TABLE XI-12

Culicine mosquitoes reported from Boetoeng Island and Kabaena Island, off Celebes

Species	Boetoeng[1]	Kabaena[2]
Aedes aegypti	+	-
A. albopictus	+	+
A. annandalei	+	-
A. scutellaris	+	-
Culex alis (vishnui(?))	-	+
C. annulirostris	-	+
C. fuscocephalus	-	+
C. quinquefasciatus (fatigans)	+	+
C. tritaeniorhynchus	-	+
C. whitmorei	-	+

Sources: 1. Bonne-Wepster, J., and Brug, S. L.: Nederlandsch-Indische Culicinen. Geneesk. tijdschr. v. Nederl.-Indië 77: 515-617 (Bar. 2) 1937.

2. Brug, S. L.: Filaria bancrofti-overbrengers op Kabaena. Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië 27: 68-98, 1938.

TABLE XI-13

Physicians reported to be in Celebes and dependencies

Place	Government public health physicians	Military physicians acting as public health physicians	Private practitioners
Banggai (Banggai Islands)	1	-	-
Baoebaoe (Boetoeng Island)	1	1	-
Boentoeng (Salayer Island)	-	-	-
Boelocekoemba	1	-	-
Bonthain	1	-	-
Kendari	1	-	-
Makassar	5	-	7
Madjene	1	-	-
Manoedjoe	-	1	-
Masamba	1	-	-
Palopo	-	1	-
Pangkadjene	1	-	-
Pareparo	-	1	-
Poso (Loemo Island)	1	-	-
Rantepao	-	-	1
Rapang	1	-	-
Singkang	1	-	-
Watampone	-	1	-
Totals	16	5	8

Source: Geneeskundig Jaarboekje voor Nederlandsch Indië, 1939, vol. 2.

TABLE XI-14

Government medical personnel in the Molukken Islands and islands in eastern part of Banda Sea

Place	Public health physician	Military physician acting as public health physician	Indonesian nurses or mantris	Vaccinators
Labocha (Batjan Island)	1	0	1	1
Sanana (Soela Island)	1	0	1	1
Amboina	1[1]	1	2[2] 5	2
Saparoea	1	0	0	1
Amahai (Ceram)	1	0	0	1
Geser (Ceram)	1	0	1	2
Honitetoe (Ceram)	0	0	0	1
Piroe (Ceram)	1	0	1	1
Riring (Ceram)	1	0	1	1
Wahai (Ceram)	1	0	0	1
Namlea (Boeroe)	1	0	1	1
Banda	1	0	0	1
Tocal (Kai Island)	1	0	1	1
Dobo (Aroe Island)	1	0	1	1
Larat (Tanimbar Island)	0	0	1	1
Saumlakki (Tanimbar Island)	1	0	1	1

[1] For the antileprosy campaign.
[2] 3 of whom worked in the leproserium.

TABLE XI-15

General and special hospitals (1,015 beds) in Celebes and immediately contiguous islands

Place	Hospital, type	Beds
A. Celebes Proper:		
1. Benthain	Government	50
2. Enrekang	District	24
3. Kaboengka	Estate	30
4. Kendari	District	30
5. Kolaka	District	20
6. Madjene	District	150
7. Makassar	Military	100
	Salvation Army	14
	Private	16
	Mission	(?)
8. Malili	District, auxiliary hospital	20
9. Mamoedjoe	District	20
	Military	(?)
10. Mara	District	10
11. Maros	Private	13
12. Masamba	District	30
13. Palopo	District	40
	Military infirmary	12
14. Pangkadjene	Private	15
15. Parepare	District	40
	Military infirmary	8
16. Rantepao	Mission	52
17. Rapang	District	14
18. Singkang	District	45
19. Watan Soppeng	District	20
20. Watampone	District	60
	Military infirmary	8
21. Wawotobi	District	24
B. Salajar Island:		
1. Boetoeng	Private	18
C. Boetoeng Island:		
1. Baoebaoe	District	42
	Military infirmary	(?)
D. Boena Island:		
1. Raha	Mission	32

SPECIAL HOSPITALS

1.	Lerang (Lariang)	Leprosarium	177
2.	Madjene (Kampong Baroe)	Leprosarium	(?)
3.	Makassar	Psychopathic	305
4.	Malili	Leprosarium	221
5.	Palopo (Kalang Kalang)	Leprosarium	41
6.	Rantepao	Leprosarium	57
7.	Singkang	Leprosarium	7
8.	Watoesampo	Leprosarium	49

Source: Geneeskundig Jaarboekje voor Nederlandsch Indië, 1939, vol. 2.

TABLE XI-16

Hospitals in the Molukken Islands and islands of the eastern Banda Sea* in 1938

Location	Beds	Administration	Physician in charge	Location physician in charge	Daily direction	Remarks
1.Labocha (Batjan Island)	18	District	Public health physician	Labocha	Public health physician	Unsatisfactory in every respect.
2.Sanana (Soela Island)	6	District	Public health physician	Sanana	Public health physician	Unsatisfactory in every respect.
3.Amboina	360	Military hospital	Military physician	Amboina	Military physician	Buildings, organization, supplies satisfactory.
4.Saparoea	19	District	Public health physician	Saparoea	Public health physician	Built in 1937, well supplied.
5.Amahai (Ceram)	20	District	Public health physician	Amahai	Public health physician	Poorly built and organized.
6.Boela (Ceram)	50	Oil	Company physician	Boela	Company physician	Built 1937.
7.Geser (Ceram)	20	District	Public health physician	Geser	Public health physician	Well organized and satisfactorily equipped.
8.Piroe (Ceram)	20	District	Public health physician	Piroe	Public health physician	Spacious and well built, average bed occupancy 15.
9.Riring (Ceram)	10	District	Public health physician	Riring	Public health physician	Primitive.
10.Wahai (Ceram)	6	District	Public health physician	Wahai	Public health physician	Admissions very scarce
11.Namlea (Boeroe)	16	District	Public health physician	Namlea	Public health physician	Physical plant unsatisfactory. Medical service good.
12.Banda	50	Private	Public health physician	Banda	Public health physician	Average bed occupancy 5.

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TABLE XI-16
(continued)

Hospitals in the Molukken Islands and islands of the eastern Banda Sea* in 1938

Location	Beds	Administration	Physician in charge	Location physician in charge	Daily direction	Remarks
13. Elat (Kai Island)	24	Catholic	Public health physician	Toeal	Catholic sisters	Subsidiary of Langgur.
14. Langgur (Kai Island)	28	Catholic	Public health physician	Toeal	Catholic sisters	Well equipped.
15. Toeal (Kai Island)	30	Presbyterian	Public health physician	Toeal	Public health physician	Formerly a school.
16. Dobo (Aroe Island)	16	District	Public health physician	Dobo	Public health physician	Well equipped but small.
17. Saumlakki (Tanimbar)	28	Catholic	Public health physician	Saumlakki	Public health physician	Overcrowded.

*In Elpapoetih (Ceram), Liang (Amboina), and Litah (Tanimbar) are emergency wards on the estates without competent medical or nursing care.

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TABLE XI-17

Leprosaria in the Molukkon Islands and Southwestern Islands in 1938

Place	Patients, no.
1. Ambcina	215
2. Banda	14
3. Bay of Elat (Kai)	(?)
4. Dobo (Aroe)	4
5. Saumlakki (Tanimbar)	40

TABLE XI-18

The incidence of bacillary dysentery in certain subdivisions of southern Celebes in 1937

Subdivision	Cases, no.
Boeloekoemba	375
Bone	355
Bonthain	140
Djeneponto	284
Pangkadjene	194
Rantepao	199
Sindjang	624
Watampone	775

TABLE XI-19

Spleen indices, certain areas
in the Soela Islands, 1923

Place	Spleen index per cent	
	Adults	Children
Sanana	41 per cent	55 per cent
Poheija	65 per cent	75 per cent
Bega	40 per cent	35 per cent

RESTRICTED

TABLE XI-20

Spleen indices, certain areas in eastern Ceram, 1923

Place	Spleen index per cent	
	Adults	Children
Atiahoe	57	64
Elnoesa	47	55
Merinama	20	36
Batoesasa	55	72
Joekbib	61	95

RESTRICTED

JANIS 156

BRIEF

JANIS 156

Brief

11. Health and Sanitation

A. Water.

The supply of water is ample in most of the islands included in this survey; exceptions are a few islands in the southeastern part of the area. Purification of water was carried out at only four places in the entire area, before the war. Only 21 towns in the entire area had distribution systems.

B. Waste disposal.

In the western part of this area a few Occidentals and some of the wealthy Chinese have cesspools; the same is true, on a much smaller scale, in the eastern part. Otherwise, the disposal of wastes is primitive, and pollution of the soil is almost invariably the rule.

C. Harmful animals.

Vectors of malaria in the western part of this area are Anopheles sundaicus, A. subpictus subpictus, A. barbirostris barbirostris and A. hyrcanus (nigerrimus ?). In the eastern part the vectors are

A. punctualatus punctulatus, A. punctulatus moluccensis, A. subpictus subpictus, A. kochi, A. sundaicus, A. maculatus maculatus and A. umbrosus. Some of these mosquitoes - A. punctulatus punctulatus and A. punctualatus moluccensis - are carriers of Wuchereria bancrofti, the causative parasite of one variety of filariasis. Aedes aegypti and A. albopictus, vectors of dengue fever, are widespread. Mansonia annulata and M. longipalpis can carry Wuchereria malayi. Body lice are rare; many species of flies occur. Dangerous mites should be expected. Poisonous snakes are present; crocodiles, wild boars, and poisonous fish are reported.

D. Food.

In the western part of this area the staple food is rice; in hill country corn is the chief food; in marshland, sago. In the eastern section of the area sago is the staple food; small quantities of corn and rice are consumed. Fish, some cattle, sheep and pigs are raised by certain peoples in the area as a whole.

E. Public health.

The public health systems of Celebes, the Salajar Islands, Banggai Islands, Toekangbesi Archipelago, and the islands of Beotoeng, Moena and Kabaena belonged to the residency of Celebes; the capital was Makassar. The public health systems of

Molukken Islands and islands in the eastern part of the Banda Sea belonged to the residency of Molukka. The chief of each system, ultimately, was responsible to the chief of the Central Public Health Service of the Netherlands East Indies, in Batavia. In the entire system curative medicine and preventive medicine were inseparably intertwined. In the western part of this area there were 32 hospitals; in the eastern part, about 17. There were no medical schools. Only two or three well-equipped laboratories were present. There were many small, local clinics.

F. Medical personnel.

Virtually every Occidental physician in this area was employed by the public health service, or was in military service, or was attached to a missionary group. A number of native physicians were employed. Dentists were rare. Forty to 50 Occidental nurses were reported; the number of mantris, or Indonesian nurses, was much larger. Midwives, vaccinators, pharmacists, dispensers, orderlies and similar personnel were present in indeterminate numbers.

G. Diseases.

Important diseases are malaria, bacillary dysentery, amebic dysentery, scrub or mite-borne typhus, shop or flea-borne typhus,

filariasis, venereal disease, and diseases of the skin. Potentially important diseases are common diarrhea, respiratory diseases, dengue fever, and influenza. Plague might easily be introduced; cholera, if not actually present, might easily be introduced. Diseases of minor military importance are typhoid fever and paratyphoid fever, conjunctivitis, schistosomiasis, Weil's disease, infectious jaundice, cerebrospinal meningitis, and a trachoma-like conjunctivitis. Diseases common among the civil population are nutritional diseases, yaws, trachoma, intestinal parasitism, tuberculosis, and leprosy. Miscellaneous diseases which occur are smallpox diphtheria, and measles.

I. Recommendations.

The following precautions are especially important in the general area under consideration.

1. All water, regardless of source, should be considered unsafe until it has received adequate treatment.

2. Adequate and safe disposal of wastes should be instituted.

3. Control of flies is imperative.

4. Proper measures to insure sanitation and control of food and food handlers should be maintained.

5. Control of mosquito-borne diseases should be inaugurated, with the inclusion of such measures as elimination of breeding of mosquitoes, safe location of camps, screening and use of sprays, insect repellents, wearing of protective clothing at night, use of bed nets, and of antimalarial drugs at the discretion of the surgeon.

6. The customary measures for protection against mite-borne typhus must be carried out (clearing of camp sites, wearing of leggings, long trousers and high shoes, impregnated clothing, and use of repellents).

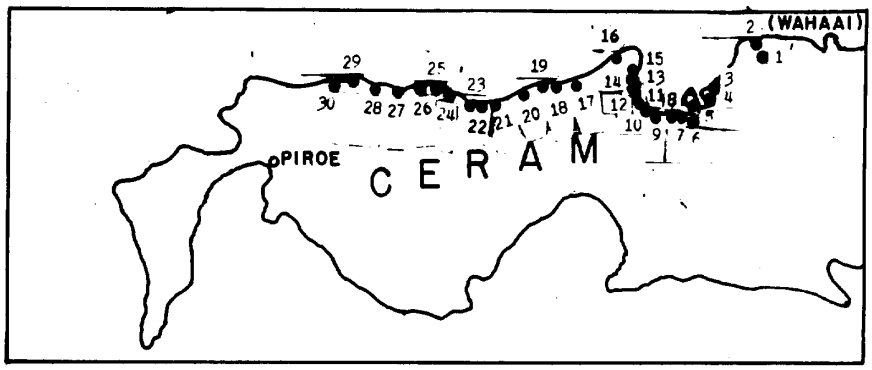
7. To control flea-borne typhus, ratproof buildings should be used and rat-control programs should be enforced. Adequate stocks of plague vaccine should be available for use if necessary.

8. Schistosomiasis, which occurs in only one small section of the area, should be guarded against by proper attention to water supplies, and avoidance of wading or swimming in infected waters.

9. Cholera vaccine should be available. Measures in respect to food, sanitation, disposal of excreta and control of flies are essential.

10. Hookworm infection can be largely prevented by location of camps on sites not recently used for human habitations, by sanitary disposal of excreta, and by adequate personal hygiene.

THE OCCURRENCE OF FILARIASIS ON CERAM ISLAND IN 1933



NUMBERS ON TABLE BELOW REFER TO NUMBERS ON MAP

NO.	VILLAGE	PATIENTS, EXAMINED, NO.	W. MALAYI POSITIVE		ELEPHANTIASIS, CASES	
			NO.	%	NO.	%
1	SOLEA MARWAN	20	2	10	1	5
2	WAHAAI	86	3 [1]	3	1	1
3	OPIN	29	7	24	6	21
4	BESI	57	4	7	4	7
5	ROEMAH OLAT	57	2	4	0	0
6	MASISINOELAN	30	0	0	0	0
7	SAWAAI	92	4	4	0	0
8	ROEMAH SOKAT	32	0	0	0	0
9	SELEMAN	82	8	10	0	0
10	HORALE-PASANEA	66	5	8	3	5
11	HORALE ROEMAH REAT	19	1	5	1	5
12	WAILOELOE-HERALAOE	46	12	26	7	15
13	PAOENI	12	2	17	2	17
14	PAX	24	0	0	2	8
15	KARLOETOE KARA	35	4	11	4	11
16	LISELA	8	5	62	2	25
17	LISABATA-ROEMAH MOLEH	43	9	21	4	9
18	ROEMAH WEH	23	3	13	4	17
19	LATEA	19	5	26	5	26
20	KARLOETOE-WARASIWA	75	4	5	3	4
21	OEWEN	52	8	15	3	6
22	SOEKARADJA	31	7	23	1	3
23	PITAELA	25	6	24	5	20
24	HATOENOEROE	77	28	36	16	21
25	RALIO SEWALIT	28	6	21	3	11
26	SOAHOEWEH (coast)	65	13	20	3	5
	" (mountain)	26	6	23	0	0
27	PASINALO NOEKOENAI	90	8	9	0	0
28	KASIEH-HOELONG	74	1	1	0	0
29	LISAHATA	25	0	0	0	0
30	TANIWAL-ROEMAH ELEN	46	2	4	1	2
	TOTAL	1394	165	12	81	6

1) In addition 2 persons infected with W. bancrofti.

Source: Brug, S. L., and de Rook, H.: Filariasis in Nederlandsch-Indië, Geneesk. tijdschr. v. Nederl.-Indië 73: 264-279 (Feb. 28) 1933.

MICROFILARIAL INDICES OF THE WAE APO PLAIN ON THE ISLAND OF BOEROE